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THE NEW YORK MEETING.

The American Association's preceding visit to the metropolis does not, when trusting to memory only, seem to have been made at as late a date as 1883, but a glance over the records reveals the fact that such was the case, and we are thus almost led to institute a comparison between the records made then at Teutonia Hall and those now being chronicled as the results of the '87 assemblage in Dockstader's. But such impulse is checked by the thought that as every tub must stand on its own bottom, so also should the doings of the separate assemblies be allowed to speak for themselves. Thus balked at the outset in the endeavor to enter fairly into the field of retrospect, we may, however, be pardoned for indulging ourselves so far as to assert that '87 would not suffer were the comparison instituted.

As a rule, the clerk of the weather is very kind to the inhabitants of our section of the country during the back end of October, when we are led from past experience to look for the most glorious days of the golden period so oddly known to common fame as Indian summer But perhaps at certain stages in the lapse of the years, the particular Indian who usually measures out the golden days in unstinted measure strays from his post with the result that a malicious substitute orders the reverse of that which would obtain were the good, though wandering, spirit in his accustomed place. Good Indian or bad, as the spirit in charge may have been, it is an undisputable truth that the evening preceding the 15th annual was a drippingly desolate one. New York city's approaches, especially those on the river fronts, are not very inviting at best, but when to their ordinary disagreeableness is added the discomfort that a sharp rainfall entails, then is the weary traveler's lot rendered a most unhappy one. However, personal discomfort did not prevent many of the delegates who intended to be first in the field from putting in an appearance at the place of rendezvous. Naturally enough the Sturtevant House, from its propinquity to the hall in which the sessions were to be held, attracted the larger number of the early birds; and by 9 P.M., or thereabouts, of Tuesday evening the halls and waiting room resounded with cheery greetings. Familiar faces beamed on every side, and all indications thus early favored the success of the New York reunion.

Wednesday dawned in gloomy manner, but the delegates were on hand in great force, and seemingly uninfluenced by the fact that rain was in the air. At the hour named for the opening of the convention Dockstader's presented a very different appearance from that which it usually takes on. The "minstrel boys" were supplanted for the nonce by men whose aim and purpose sought that advancement in their profession which is best brought about by open council and honest interchange of expression and opinion. We had counted on a larger attendance, not that it was not a numerically strong one as it was; but the Association's muster roll has been largely added to since the last gathering in New York, when the members present at least equalled, if not exceeded, in number those who responded to their names this year. A consideration of this brings to mind the fact—for it was made quite apparent during the discussion which followed the acceptance of Mr. Pearson's invitation to the Association to hold its next annual meeting in Toronto, Canada—that the sentiment of many favors a change in the date for holding the annual reunions of the Society. The objection has been urged to the present practice that it obliges the delegates to be away from their working districts at a time when the demands from their consumers are beginning to assume huge proportions. It seems to be thought that the last week in September, or at the latest, the first week in October, would better suit the convenience of the majority; still, in accordance with the Constitution of the body as at present modelled, the majority could not move off-hand (meaning without a year's delay) in the matter of a change without securing unanimous consent. This, it is almost unnecessary to say, could not be obtained. We also note that in the draft of the new Constitution submitted at this meeting by the Executive Committee it is proposed (see Sec. 34) to retain the 3d Wednesday of October as the initial meeting day. However, when the new form shall come up for consideration the objectors will be afforded ample opportunity to show their strength.

One particularly pleasing thing to the convention was the presence of three gentlemen, out of those whom it felt delighted to honor in the past with an election to honorary membership—Dr. Henry Morton, President of the Stevens Institute of Technology; Mr. R. P. Spice, perhaps as well

known to the whole gas world by his *sobriquet*, "The Hermit of Westminster," as by any of the other titles earned in connection with engineering pursuits, and whose annual visit to America to attend the Association's meetings is regularly and pleasurably anticipated; and Dr. E. G. Love, the clever and competent official gas examiner for the metropolis. Yet another distinguished visitor was present in the person of Mr. F. E. Barker, a member of the Massachusetts State Gas Commission, a body which has, by its careful and conservative action so far, demonstrated thoroughly the value of, if not the necessity for, having such a board of arbiters to intervene between the gas maker, the gas consumer and the bond maker. Of course, many faces were missed from amongst the gathering whom we would have wished to see—notably the sage of Indianapolis; but the roll call tells the story.

Once settled down to work, the discrimination of the veriest tyro in such matters would be sufficient to enable him to comprehend the fact that a master hand was on the gavel; and it is not at all too much to say that were it not for President Greenough's apt and firm rulings, some portion of the third day—set apart for guidance at the hands of the local Committee of Arrangements—would have to be devoted to a business session; that is, if the technical matters before the convention were to have been properly taken care of. The report of the Executive Committee was more than ordinarily interesting this year, chiefly because of the draft of the new Constitution submitted. We give it in full in our other pages, and presume it will receive that careful attention which the importance of its future effect on the Society calls for. Some of its provisions, notably sections 38 and 39, we are at first glance disposed to view unfavorably, because they seem to open the way to methods of procedure which might sometimes border on those of the star chamber order. It will be noted that three papers were read whose titles did not appear in Secretary Humphrey's final official notice. Although unanticipated, they were, nevertheless, completely appreciated. One of these, "The Use and Value of Coke for Generating Steam," by Mr. J. L. Hallett, of Springfield, Mass., was prepared in response to the Secretary's especial appeal for information of that description; while President elect Turner's "Purification Puzzles," aside from its technical value—and owing to the train of thought it opens up, to say nothing of the masterly manner in which the subject was treated, that value is very great—affords ample proof that his pledge* made to the '86 meeting was kept to the letter. The papers, as a whole, probably exceed in interest those hitherto read at any of the Association's gatherings, and where all are meritorious it would perhaps savor of bad taste to single out any for especial comment. Speaking simply for ourselves, we incline to the view that those which will be found of especial interest to the fraternity at large are contained in the manuscripts submitted by Messrs. Nettleton, King, McMillin, Humphreys, Jones and Hallett. However, those which do not appear in this issue will speedily be given to our readers, and they constitute a jury perfectly qualified to decide without fear or favor.

President Greenough's address is just what might be expected from a man who carefully weighs what he wants to say before saying it, and that style of measurement is much preferable to the one which consists of speaking first and then attending to the delicate matter of adjusting the scale-weights. Mr. Westinghouse will, with others interested in another direction as well, receive cold comfort from his candid utterances. In one case, however, we feel that we would be untrue to ourselves did we not dissent from his conclusions in regard to the Institute proposition now under consideration by a special committee of the Western Association. We fail to see wherein Mr. Egner's suggestion is not in every way superior to that proposed as a sort of substitute at the New York meeting. Paying no need to the minor objection about the name selected, which may or may not be considered inappropriate according as individual fancy dictates, we venture to say there will be no difficulty in obtaining a score of working managers for the Institute, who could and would be trusted implicitly, if such a duplication were deemed necessary. In our opinion, all the whipping that can be devoted to it would not cause the Investigating Committee to even remotely answer the purpose for which it has been created. There is too wide a division of responsibility. We may be mistaken in this, but are yet with Mr. Egner. However, Toronto and '88 will develop something tangible, either for or against. The address is a vigorous one, and its lessons are many and valuable.

Those who have not attempted the task, strange as it may seem, can have no idea as to the difficulty of arranging for the organized entertainment of many people in the city of New York, at this season of the year especially. Countless visitors throng the hotels, and the suburban outlets are bleak and cheerless. Despite these drawbacks the local committee of arrangements were equal to the contract, and acquitted themselves in royal fashion. Such a long period of time has elapsed since the festivities of the occasion that any extented mention of them now would be rather tame. The first "independent" banquet of the Association was spread in Lyric Hall, by caterer Terhune; and his name is a sufficient guarantee that profusion and elegance signalized the *menu*. President Greenough played the role of entertainer with grace and tact, although at one time his wand of office looked rather awe-inspiring.

The excursion party who were to board the iron steamboat Cygnus at 10 A.M. of Friday, were somewhat inclined to doubt the pleasure of the trip, for the clouds were lowering and a rather stiff northwest wind reminded them that "it was an eager and a nipping air." However, the weather conditions righted somewhat before the start was made, and improved continuously throughout what turned out to be a delightful journey to the 180—of whom perhaps 50 were of the gentler sex—who participated in it. Leaving the foot of West 23d street the Cygnus made here way down the North or Hudson river to the sister stream whose broad and surging waters have been conquered by the noble pile known to all the world as the New York and Brooklyn Bridge, thence on and up to that famous retreat known as Blackwell's Island. Returning over the same course, entrance was made, through Buttermilk channel, to the Narrows, on past the forts, including dismantled Lafayette, reposing dark and grim in the path of the ocean voyager, and redolent with memories of '61. A few miles further on, and with Coney Island's sands glistening in the struggling sunbeams, the Cygnus deftly swung about, and ploughed her way once more to the beautiful Hudson. The return passage enabled the voyagers to become acquainted with Madame Liberty, who, from her lofty height on Bedloe's Island, holds out the light of hope. Then on up through the Hudson, amidst a bewildering change of scene, every succeeding feature of which seemed more beautiful than its predecessor. The hour was growing late, and that necessitated the order for a return to be made when Sing-Sing had been reached. Luncheon and dinner were served at appropriate times, and an excellent band of music enhanced the pleasure of the voyagers. In fact, when the dinner had been discussed, the music proved so irresistible that the "decks were cleared for action," and many couples were speedily engaged in paying active devotion to the goddess of the twinkling feet. The point of debarkation was reached in good time, and thus ended a most pleasant day—fitting sequel to a red-letter convention of the American Gas Light Association.

* The Charleston Gas Company suffered great damage from the earthquake shocks in that locality in '86. President Turner, having recited some of the losses incurred, closed the narration by saying, "Although badly wrecked, we propose to go ahead."

Effect of Carbonic Acid on Illuminating Power of Coal Gas.

Mr. C. W. Hinman, Gas Inspector for the State of Massachusetts, under date of Boston, Mass., Oct. 24, writes as follows:

"I see in your last issue an article, by Jno. T. Sheard, originally published in the London *Journal*, on the "Effect of Carbonic Acid upon the Illuminating Power of Coal Gas." The article in question is a valuable one, and it gives a series of determinations of the loss of candle power arising from the presence of from 1 to 2¾ per cent. of carbonic acid in the gas. Mr. Sheard's knowledge of the literature of the subject appears, however, to be somewhat limited, as he only mentions two or three experiments by Mr. C. J. R. Humphreys, on gas containing 1½ per cent. carbonic acid. Mr. Lewis T. Wright, some 30 years ago, made a series of determinations of the effect of varying amounts of carbonic acid on the light produced. Mr. Fred. E. Stimpson also investigated the subject. In my report to the Massachusetts Legislature for the year 1882 may be found the results of several experiments. Also Dr. Percy R. Frankland, in the *Jour. Chem. Soc.*, London, 1884, gives the results of mixing various amounts of carbonic acid with ethylene. As my own results are contained in a report which only a few gas men have ever seen, and which has never been republished, I may perhaps be pardoned for referring to the results. The gas, both free from carbonic acid and containing various quantities of it, was burned both from an Argand burner and from a slit steatite burner. The gas was in all cases burned at the rate best adapted to it, which was not far from 5 feet per hour. The following are the results:

Argand Burner.

Carbonic Acid in Gas.	Loss of Light.	Ratio.
1.3 per cent.	2.3 per cent.	1.8
2.8 "	5.4 "	1.9
4.9 "	9.2 "	1.9
7.5 "	15.1 "	2.0

Slit Burner.

1.4 per cent.	6.3 per cent.	4.5
2.5 "	12.4 "	5.0
3.9 "	16.9 "	4.3

The gas had an illuminating power of about 19 candles. If Mr. Sheard's results are calculated on the same basis as mine they give, with the Argand burner, the ratio of the loss of light to each per cent. of carbonic acid as 2.5, and with the open burner the ratio becomes 5.1; or he found carbonic acid to have a somewhat greater effect than my experiments indicated.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Oct. 10, 1887.

Effect of Gas on the Binding of Books.—A Coal Gas Basis.—The Claus Process.—Advice to Gas Consumers.—New Filling for Coke Scrubbers.—The North of Ireland Association of Gas Managers.

Mr. C. J. Woodward, of Birmingham, has been trying some experiments with strips of leather, by exposing them to an artificially foul atmosphere, for a period of 1,000 hours. The impure atmosphere was obtained by burning a jet of gas in an unventilated fume cupboard in sufficient quantity to produce a temperature ranging from 130° to 160° F.; and the object in view, in submitting the leather to this slow cooking process, is to exemplify the effect of the products of gas consumption upon the leather bindings of books in public libraries. The most straightforward way of doing this would be to go to the libraries and examine the books, and if necessary to arrange for a series of experiments under ordinary circumstances. It is not the usual custom to put books for preservation in an unventilated hot closet, having an abnormally hot and foul atmosphere; and the phenomena obtained under such conditions cannot be accepted as any indication of that which actually occurs in ordinary libraries. Mr Woodward tested the strength of his strips before and after their hot bath, and found that they were weakened both as regards elasticity and breaking strain to the extent of 50 per cent. or so. They were also found to have absorbed an appreciable quantity of sulphuric acid, ranging from 1 to 3 per cent., presumably from the sulphur compounds present in the gas; but it is interesting to notice that the extent of depreciation in strength is in no way proportioned to the quantity of sulphuric acid absorbed. I make a special point of this, because it has always been usual among opponents of gas to quote "the sulphur compounds" as especially liable to cause corrosion of book bindings, hangings, curtains, etc., but Mr. Woodward's experiments distinctly show that they are not all concerned in the matter. This question was well threshed out in the great sulphur fight of 1887, before a Parliamentary Committee, on the occasion when the Gas Light and Coke Company, and also the Crystal Palace District Gas Company, sought to be relieved from the sulphur clauses imposed upon them by Parliament, which limited the quantity of these substances allowed to be present in the gas under heavy penalties in default. The applications were opposed on behalf of the consumers, and no expense was spared on either side. A great number of expert witnesses gave evidence, in some cases illustrating their views by experiments performed before the Committee. The general evidence went to show that excessive heat and want of ventilation were the chief factors in producing the injury to property attributed to the sulphur compounds, and this view is distinctly supported by Mr. Woodward's experiments.

A new system of selling gas has been originated by the directors of a small gas undertaking in Scotland, who have recently changed from coal to paraffine oil as their staple material. The oil gas is said to be of 60-candle power, and, of course, one result of introducing such a great improvement in photometrical value was a diminution in the quantity required. The consumers found that a less quantity of gas was necessary to produce the same amount of light. Under these circumstances, instead of directly announcing that the price of the gas would be increased in proportion to the increase of quality, some imaginative genius on the board hit upon the happy plan of selling according to a fictitious mode of calculation which he dubbed the "coal gas basis." Assuming that the oil gas was worth two and a half times as much as the coal gas, this convenient process consisted of multiplying the consumption, as indicated by the meter, by 2.5. It is beautifully simple, and the advantage of the "basis" to the directors of the gas company is obvious; formerly they received $1.90 per 1,000 cubic feet, but this figure, under the magical influence of the "basis," becomes $4.75 per 1,000 cubic feet. Unfortunately the consumers do not see matters in this light. They fail to appreciate the argument, and insist that gas sold at the price last named must necessarily be much dearer than the old coal gas; and they also object to having the "basis" forced upon them. I think that under any circumstances it would be difficult to raise the price of gas to the extent of 2.5 times, notwithstanding the fact that equal value may be given in quality. Consumers need instructions in the way of using such rich gas to the best advantage. But matters are not likely to be assisted by introducing roundabout ways of dealing, like the "coal gas basis," which only increase difficulties by creating suspicion and distrust.

A recent issue of the *Journal of Gas Lighting* contains an interesting article on the Claus system of purification, by Messrs. Heaton & Watts, the chemists who have superintended the experimental trial on a practical scale that has been conducted at the Winsor street gas works, Birmingham. In this system the gas, after being freed from tar, is treated in scrubbers or washers with caustic ammonia, separately and continuously prepared from gas liquor, with a regulated quantity of sulphur, and finally with the spent liquor from the ammonia still. In this way it is purified as completely as is possible by the usual process entirely by the use of liquids in closed vessels, whilst sulphur in the solid form, and other valuable by-products are obtained. The advantages claimed are, therefore, avoidance of nuisance—an important point in the case of gas works situated in crowded or near fashionable localities—some economy in labor, seeing that liquids are more cheaply moved about than solids, as they can readily be pumped from place to place, and some addition to revenue by means of the bye-products recovered. The gentlemen above named give an exhaustive description of the plant used, and conclude with an estimate of the cost, based upon their experience at Birmingham. The gross cost works out to 7.4 cents per ton of coal; but against this must be credited sulphur, ferrocyanide of potassium, and economy in the manufacture of sulphate of ammonia, which works out to 13.18 cents. So it will be seen that there is a clear profit due to the process of 5.78 cents per ton of coal carbonized. The estimate, however, is not complete. It does not include interest on plant, allowance for repairs and depreciation, or for the royalty that would have to be paid by other users. Taking these issues into consideration, it is too much to expect that it could be worked at a profit under ordinary circumstances; but at the same time there is no reason why it should not be cheaper than the ordinary dry process.

Mr. Veevers, of the Denton Local Board Gas Works, has issued a circular for the use of his customers, in which he points out that although the meter is usually correct, the majority of the consumers do not get the equivalent in illumination for the amount of gas they pay for. This state of things is brought about by the gas being burnt under improper conditions, the most common of which is excessive pressure. Having enlarged on this point, he passes on to notice the advantage of using a good automatic governor at the outlet of the meter, examples of which may be seen at the gas works, and proceeds to remark that ordinary burners require to be changed, in the interests of economy, about once a year. He warns gas consumers against the pretensions of hawkers who sell inferior burners at a high price, and announces that the best make of burners may be obtained at the gas works at cost price. Many efforts have been made of late years to instruct consumers. The example set by the veteran Mr. Rutter, of Brighton, who issued pamphlets for the use of consumers about half a century ago, has found many followers, but yet there remains much to be done. At the same time we may congratulate ourselves that there is a marked improvement in the methods of using gas. Consumers begin to recognize the intimate relation between the description of burners they use and the value they receive in return for the money they spend in gas.

At the recent meeting of the British Association Prof. Lunge described a new apparatus he has arranged for condensing or absorbing gases by contact with liquids. It consists of a tower scrubber packed with a special kind of tile. These tiles are flat, and so shaped that they may be packed in layers. They contain fine perforations about half an inch apart, and are so arranged that the holes in one layer baffle with those of the next. A small annular ridge or projection stands about one-eighth inch above the top surface of the tile, around each hole, and there are also ridges extending in parallel lines and at right angles, so arranged as to form a shallow cup or basin surrounding each hole, which retains a small quantity of liquid. The liquid descending through the holes drops upon the ridges in the layer next below, and is thus evenly distributed and diffused. If the holes are so small as to be plugged by the drops of liquid, a further advantage is secured. This form of scrubber may be commended to the attention of all who are experimenting with liquid purification, but it is obvious that the gas must be thoroughly free from tar before passing into it.

A gas managers association has just been formed in Ireland, under the title of "The North of Ireland Association of Gas Managers." Mr. E. Stears, of Lisburn, was elected as the first President, and Mr. J. Whimster, of Armagh (at whose works the first meeting was held), as Secretary and Treasurer. A committee of six was also elected, to manage the affairs. Fourteen of the gentlemen present entered their names as members, and Mr. Whimster was able to announce that eleven others had signified by letter their desire to join the Association in the event of its being formed. Two extraordinary members were also nominated. It was decided that the annual meeting should be held on the second Tuesday in August in each year. The subscription was fixed at 5s. per annum for ordinary members and associates, and half a guinea for extraordinary members. The committee was requested to prepare a list of

rules, and to submit the same to the members at the first general meeting which is to be held at Lisburn. The newly-fledged President and Secretary then proceeded to inaugurate their new duties in an appropriate manner, by respectively occupying the chair and the vice-chair at a social dinner. In the after proceedings, it is needless to add, the toast of the new Association was proposed and enthusiastically received.

For some few years past the gas managers of Ireland have recognized the disadvantage at which they were placed in not possessing a distinct Association, and various efforts have been made in the way of bringing about a meeting for the formation of the same. It remained, however, for Mr. Whimster to promote the successful gathering, on the occasion above mentioned. It should be observed that the business meeting was by no means a proceeding of mere routine. An animated discussion took place, which showed that the matter had been well digested by several of the gentlemen present. Altogether the Association has made an excellent start—quite as good as the Gas Institute and our English District Associations. It only remains to express a hope that the result of the meeting at Armagh may be the gradual development of a sound and healthy Association, that will serve as a source of wholesome instruction and benefit to its members for many years to come.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Public Lighting at Detroit, Mich.—The people of Detroit appear to be in a quandary over the lighting of their streets. They are far from being satisfied with the imperfect service, despite the steep figure paid for the same, rendered in the near past by the Brush Company, but they are not disposed to forego the arc system of illumination. The Brush folks, however, seem to think that "all things come to those who wait," and consequently are indisposed to reduce the figure (as to time or money) submitted by them to the authorities. The Detroit gas companies in the meantime have asked the Council to consider a proposition to readmit them to the public lighting field. Briefly stated, the gas men say: "If necessary, enter into a contract with the Brush Company to light the city for another year, at the expiration of which period we will be in the field with an electric plant. Then you (the city) will be in position to have, at least, whatever benefit attaches to *bona fide* competition." This proposition seems likely to shut the Brush Company out from a three-year's grip on the fund for lighting Detroit's thoroughfares. It might be said that some of the Detroiters want the authorities to purchase the local Brush plant and operate it on behalf of the public.

Getting Ready for the Winter's Work.—The Stacey Manufacturing Company is constructing two gasholders on the Water street property of the Fall River (Mass.) Gas Company. We understand that this construction will put an end to many a complaint indulged in of late years by the Fall River gas consumer, who seems to be somewhat crankier than even the average growler of his class. It appears that the old holders were inclosed with wooden housings, and that fact led some consumers to ask how it was "possible for them to obtain a good supply of gas when the Company employed barns for storehouses!"

Public Lighting at Morristown, N. J.—After several months of delay the Morristown Council has decided on how that city is to be lighted for the ensuing year. Mayor Wertz, as the result of a special meeting recently held, was authorized to execute a contract with the Gas Company for a certain number of gas lamps at the rate of $16 each per annum; also to contract with the electric light company for 12 or more arc lights, at $120 each per year, and one (or more) incandescent lights, at the rate of $17.50 per annum. Judging from the indefiniteness of the electric lighting portion of the agreement, it looks as if electricity might be called on to perform the lion's share of the illumination.

Approaching a Termination.—If indications can be trusted the protracted Baltimore, Md., war of gas rates is about to end in peace and plenty. The Baltimore *Herald* (of Oct. 21) says in regard thereto: "There is now little doubt that the war between the Consolidated and Chesapeake Gas Companies is liable to be settled at any moment. Two days ago Mr. J. W. Hall, President of the Consolidated Company, went to Philadelphia, where he met President Benedict, of the Chesapeake Company. Yesterday the executive committee of the Consolidated held a meeting, and rumor had it that the session was called for the purpose of making the final arrangements for a settlement. Another important fact that tends to show conclusively that consumers will not long get gas at 50 cents per thousand is that both companies have withdrawn their canvassers. The rumors of the approaching settlement had the effect of making Consolidated stock very active, sales being effected at as high a figure as 63. Upon what basis the settlement will be made it is hard to determine, but the general supposition is there will be an equal division of the business of the city between the two companies, and that the price of gas will be advanced to $1.25 or $1.50 per thousand." Springfield (Mass.) papers please copy. [An agreement has been reached.]

The Cost of It at Paris, Ills.—We are informed that it costs the town of Paris at the rate of about $4,000 per annum to operate its electric lighting plant.

In Place of T. B. Catherwood.—Some time ago we had occasion to announce that T. B. Catherwood (who acted in the capacity of accountant to the Savannah, Ga., Gas Light Company), owing to irregularities, had been discharged. His place is now filled by Mr. W. J. Golden.

It Might have been Worse.—The Winnemucca (Nev.) Gas Company's plant had a narrow squeak from destruction by fire about a fortnight ago. Prompt action, however, saved the citizens from the necessity of groping in the dark o'nights—for a time at least.

Doubling Up.—The Augusta (Ga.) Gas Light Company is about to double its gas making capacity.

Electric Light in San Francisco, Cal.—According to the report of the local gas inspector the California Electric Light Company supplies the city with 16 masts—15 of these are 150 feet in height, each—which carry a total of 61 lamps of the nominal 2,000-candle power sort. Each lamp is paid for at the rate of 66 cents per night, the lights being in duty on 329 nights of the year.

A Retort House Roof Comes Down.—Shortly after midday of October 16, the stokers employed in the retort house of the Metropolitan station of the Consolidated Gas Light Company, of this city, were treated to a great surprise. The house is on the south side of 42d street, and is about 275 feet in length by 60 feet in width, the walls being perhaps 22 feet high. The roof frame, etc., is of the truss pattern, and, it is said, was constructed originally in 1861. It certainly looked substantial enough, and had been inspected in September last. The result of that inspection caused certain minor repairs to be made on the structure, which presumably put an end to all doubt concerning its stability. At the time noted above, however, the workmen, who were about to resume their labors at the end of the midday recess, were startled by an ominous cracking sound. Glancing upwards it was seen that the eastern end of the roof was swaying as if subjected to the influence of a sudden gust of wind. The trembling lasted for some seconds, thus enabling those furthest from the section first affected to escape into the yard. To employ the words of one who witnessed the occurrence: "The roof began to fall at the eastern end. About 30 feet of it came down in a lump, and then the impulse was slowly communicated from girder to girder and along the whole length of the structure until it was all down. This took several seconds, and it went down like a row of bricks set on end." Five of the employes were unable to make their escape, but strange to say all escaped fatal injury. While the house after the crash looked like a pretty bad wreck, a clean up showed that none of the benches suffered material damage, and the operation of gas making was not interrupted. Many theories have been put forth in explanation of the disaster, but these differ so widely that it is better, perhaps, at the present time not to mention any of them. Among the injured was Supt. W. B. Lundie, who, besides having a fractured leg, also suffered the loss of a portion of his scalp. His wounds were of a most painful nature, and necessitated his removal to the Roosevelt Hospital, the surgeons of which institution informed him that weeks would elapse ere he could emerge from their care. To make matters worse Mr. Lundie had previously arranged for a most important event, the latter being nothing less than his marriage to a most estimable lady, the day for the ceremony having been announced for Oct. 17. The fiat of the surgeons was smiled at by the sufferer, who said they might better have employed the word "days" instead of "weeks." Mr. Lundie knew what he was talking about, too; for on the afternoon of Oct. 24 he instructed the physicians to adjust his splint encased limb with more than ordinary care, because he intended to become a Benedict on that day. They demurred, but he insisted. Finally, his persistence conquered, and in a short while the courageous Superintendent, comfortably (at least in a measure) reclining on his bed, was carried down to a vehicle in waiting and driven to his home, where he was united in marriage to the woman of his choice. As a morning daily puts it: "Mr. and Mrs. Lundie are now on their wedding trip, and it is not to the hospital, either." A pretty determined man Mr. Lundie evidently is, and his action proves that love not only laughs at locksmiths, but at doctors, too.

In New Hands.—On Oct. 18 the entire plant of the Belvidere (N. J.) Electric Lighting Company was sold, at public sale, to Geo. F. Wiley, of Phila., Pa., by John Simerson, auditor. The latter acted in accordance with an order of the court under an attachment suit. The plant consists of

a complete outfit, the property being seized by the sheriff about six months ago, on the night the first trial for lighting the town was to be made.

ALL IMPROVEMENTS.—Something over a fortnight ago the Supervisors of the town of Bakersville, Cal., granted franchises for the operation of a street railway, a gas and electric light company, and a water works. Judging from this, Bakersville must be enjoying considerable of a boom. Bakersville is the capital of Kern county, Cal., and is located on the Kern river at a point close to the line of the old Visalia division of the Central Pacific Railroad. It is 300 miles southeast of San Francisco.

KILLED BY THE CURRENT.—On the morning of Oct. 18 a lineman named Borcher, in the employ ot the New Orleans (La.) Telephone Company, was stringing a telephone wire through Lafayette street to the Exchange on the corner of Poydras and Carondelet streets. Everything progressed smoothly until Rampart street was reached, where it became necessary to cross a Brush electric light wire. No danger was anticipated from this wire—it was a small copper wire insulated, and supposed not to carry more than 100 volts of current. Instead of that it came direct from a Brush main line, and when the telephone wire was thrown over it Borcher, who was letting out the slack, received a shock which killed him instantly.

CONTRIBUTED BY THE GAS COMPANY.—The illumination of the city of Charleston (S. C.) during what is known as Festival Week was quite a success. At one time it was feared that such a verdict could not be rendered, but the public-spirited action of the proprietors of the Charleston Gas Light Company—who agreed to furnish gas for the festive illumination of those quarters of the city to which the plant of the electric light company did not extend—alone made it possible.

DID SOME OF THE MONEY GO TO HIS SHIRTMAKER?—The Leadville (Col.) Illuminating Gas Company has filed a complaint in the District Court against ex-Senator H. A. W. Tabor, the complainant seeking to recover the sum of $43,000. It is alleged in the complaint that several years ago the Company, needing money, issued bonds for $100,000, which were secured by the usual trust deed. These bonds were intrusted to Mr. Tabor, who at the time was President of the Company, with instructions to dispose of them and, with the proceeds, to settle its out-standing debts. Mr. Tabor sold the securities and settled with the Company's creditors. It is claimed that a balance of $27,000 remained in the President's hands, which sum has not been turned into the Company's treasury. That balance plus interest is what the Company wants the ex-Senator to pay over.

INCORPORATED.—Articles incorporating the Francis Incandescent Gas Lamp and Regulator Company have been filed with the Recorder, St. Louis, Mo. The capital is fixed at $20,000, and Messrs. M. Treadway, J. P. Richardson, J. L. Huse, Jos. Peters and H. T. Kleibacher are returned as stockholders.

IN WORKING ORDER.—The new electric light plant for the supply of Ashtabula, Ohio, was started up on the evening of Oct. 18.

REFUSED.—In our last issue we mentioned that certain residents, whose premises were in proximity to the site chosen for a gas works by the proprietors of an opposition gas company, at Owensboro, Ky., petitioned the City Council to refuse the newcomers a building permit. The opposition was based on the ground that a gas works would depreciate the value of the remonstrant's property. The Council considered the petition on the night of Oct. 18, and it was determined not only to refuse the permit, but also to establish an ordinance probibiting any gas company from erecting a works for the manufacture of gas within the city limits without first obtaining a permit from the proper authorities.

ELECTRIC LIGHT FOR CATSKILL, N. Y.—The Cauterskill Electric Light Company, to light the village of Catskill, has been incorporated. Capital, $20,000. Trustees, J. H. Posson, W. H. Palmer and Eleanor Posson, all of Catskill.

A WORD FROM DENVER, COL.—The new plant hitherto spoken of by us as being in course of construction, has been fired up. The Denver *Republican* says that Bro. Fay's new property is complete and handsome. Work on the conduit in which the local electric light company proposes to place its wires is now underway. Perhaps the New York city subway commissioners might receive a useful hint or two about the matter they are supposed to have under consideration were they to visit the "Elevated City."

ELECTED DIRECTORS.—At a recent meeting of the stockholders of the Schuyler Electric Light Company, held at Middletown, Conn., the following were elected Directors: Messrs. J. M. Camp, H. Woodward, O. V. Coffin and S. H. Butler, of Middletown, C. E. Dustin, of Hartford, F. Foster, of Fitchburg, Mass., and C. N. Wayland, of New York.

PUBLIC LIGHTING, HOOSICK FALLS, N. Y.—A tthe mid-October meeting of the Board of Trustees of Hoosick Falls, the principal object discussed was the granting of a contract for the lighting of the streets by electricity. The bidders included the local Gas Company, J. W. Wakefield, of Portland, Me., and Messrs. Holmes, Locke and Hurd. After a protracted session and many ballots the contract was awarded to the last named, and they bound themselves to have everything in readiness for the work in hand before Jan. 1st. Further than that the Trustees adopted a nominal 1,200-candle power arc as the standard, we are unable to say anything in regard to the conditions which bind the contractors.

HOW OFFICIALS ARE SELECTED AT WHEELING, WEST VA.—The Wheeling gas works are owned by the city, and are managed by a board of Trustees, the latter being selected every two years. The Board, of course, have the right to say who shall serve under them, and the result is that the political leanings of the Trustees cause changes to be made oftener than would seem for the best interest of the property under their care. With so much in explanation, the following letter received by us from a Richmond (Va.) correspondent will be readily understood: "The new Board of Trustees of the Wheeling Gas Works, comprising Messrs. F. P. Jepson, T. E. Lewis and H. Seamon, met on Oct. 18 for the purpose of selecting some of the officials to practically manage the gas plant for two years, beginning Nov. 1. These consist of Secretary, Assistant Secretary, Collector and Superintendent. Not much interest attached to the filling of the three first-named places, and the following gentlemen were chosen to perform the duties attaching to the different berths: Sec., A. J. Seamon; Assist., S. F. Faris; Collector, C. A. Reed. Now, however, came the real tug—the Board room was liberally sprinkled with the faces and forms of those prominent in Wheeling politics. Two years ago, or when a democratic Board was chosen, they found the Superintendent's position filled by Mr. Jas. M. Dillon, who was acknowledged to be a thoroughly capable man, in all respects save that of his politics. He knew how to run a gas works, and gave every satisfaction to the people for years; but the democrats wanted a man of their own faith, and replaced him in the person of S. M. Darrah, whose democracy was unquestioned. Not a word can be said against Mr. Darrah on the score of fitness; in fact his administration during the time he has been in office has given unqualified satisfaction. However, the political tide having once more turned, and as soon as the result of the last civil election was made known, the republicans made no secret of their intention to return Mr. Dillon to his old place. Well, they kept their promise. When the other berths had been filled by the selection of those named above, a ballot for Superintendent (only Messrs. Dillon and Darrah were placed in nomination) resulted in the election of Mr. Dillon, although Trustee Jepson voted for the retention of the present incumbent. Justice would certainly seem to be served by the action taken, and we must concede that Mr. Darrah, in any event, can have slight cause for complaint at the result. Still it would be better for all concerned if the Superintendency of the gas works was removed altogether from the field of political prizes, for it seems to me that the gas consumers want gas and not politics. In conclusion I submit that the Wheeling instance affords a good reason, as is advocated frequently by some enthusiasts, why the gas supply of a city or town should never be operated or controlled as a public measure."

GAS FOR MOORHEAD, MINN.—Some time ago we noted that the residents of Moorhead wanted gas, and that a project for the establishment of a plant was being considered. Now as Fargo, although located in Dakota Territory, is only one mile west of Moorhead, and as Fargo already rejoiced in the possession of a gas works, the proprietors of the latter proposed to meet Moorhead's gas wants from their mains. They applied to the Moorhead Council for a franchise, which was granted, that guarantees them the exclusive right to supply gas in the new territory for a period of 20 years. The connecting link (in the shape of a gas main) is now being buried.

IN CHARGE AT CHEYENNE, WYO. TER.—Mr. N. L. Maher has been for some time past in charge of the works of the Cheyenne City Gas Company.

THE DALLAS CITY (TEX.) BOOM STILL IN BLOOM.—A letter recently received by us from Mr. Wm. Enfield, Supt. of the Dallas City Gas Light Company, says, among other things: "The boom of last year shows no signs of collapse; in fact, if anything, we are busier than ever. Since coming here I have been obliged to double the capacity of the plant, and now we are working it to the limit, with every prospect of being speedily called on to double up once more. The electric light does not hurt, but has rather relieved us. Put it down that our people are not discouraged. Our new 110,000 cu. ft. holder works finely. The holder and tank are as tight as drums." Work never did frighten Bro. Enfield.

RESIGNED.—We are informed by Mr. W. H. Hopper that he, on Oct. 18, resigned his position as Assistant Treasurer (at Philadelphia) of the Ameri-

can Meter Company. Mr. Hopper's connection with the Company dates from 1870.

THE COST OF IT.—The building to house the plant of the American Illuminating Electric Light Company, of Jacksonville, Fla., according to the local *Times-Union*, is said to have cost $1,200. A gas company would have saved that sum in construction, perhaps.

AT WORK.—The Hauss Electric Light Company, of Chattanooga, Tenn., expected to be in readiness to supply light yesterday.

THE PACIFIC GAS IMPROVEMENT COMPANY, of San Francisco, Cal., can supply a maximum demand of 1,500,000 cu. ft. per diem. Up to Oct. 1 the Company's main system comprised 67 miles of pipe. The old San Francisco Company's capacity is equal to a daily demand of 5,000,000 cu. ft., and it owns 220 miles of street mains. The salary and expenses of the California Gas Inspector (R. F. McCarthy) were returned for the year at $1,857.75.

PERSONAL.—Mr. R. P. Spice, otherwise known to gas men as the "Hermit of Westminster," sailed for home on the steamer Umbria on Oct. 29.

PUBLIC LIGHTING, STOCKTON, CAL.—Mr. C. A. Campbell, City Clerk of Stockton, asks for sealed proposals, which will be received up to 7:30 P.M. of Nov. 14, for the public lighting of that city for a period of two years from Jan. 1, 1888. Four forms are submitted, viz.: First, for lighting the streets with gas, either natural or manufactured; second, for lighting with electric lights; third, for lighting with gas and electricity; fourth, with any material or substance other than those before mentioned. The "form" also prescribes that "if the contract be awarded to any person or persons not having pipes or apparatus already in place, the City Council may allow until the first day of April, 1888, for preparing themselves for the work, and the contract shall run two years from that date."

PLENTY OF ZIRCONIA.—Prof. Brooks, late State Geologist, says that zirconia is found in inexhaustible quantities, and easy of access and removal, in several sections of California. The most important deposits are located in the following sections: Arroyo Seco and Irish Hill, Amador county; Spring Valley hydraulic mine, Cherokee, Butte county; Picayune Flat, Fresno county; in the sands of the Novarro river, Anderson Valley, Mendocino county; and at Eagle Gulch and Rock Island, Plumas county.

CHANGE IN TITLE.—The publication hitherto known as the *Sanitary Engineer* now bears the title, *The Engineering and Building Record*. Mr. W. H. Brinckerhoff, C.E., has accepted a position on its editorial staff. We wish him every possible success in his new line of work.

ANNUAL ELECTION, MANSFIELD, OHIO.—At the annual meeting of the Mansfield Gas Light Company, and the Mansfield Electric Light and Power Company, the following officers were chosen: For the Gas Company, President, L. A. Strong; Vice-President, S. E. Bird; Treasurer, Jos. Hedges; Secretary, W. C. Hedges; Supt., G. S. Harris. For the Electric Company, Prest., S. E. Bird; Vice-Prest., J. B. Netscher; Treas., Jos. S. Hedges; Secy., W. C. Hedges; Supt., G. S. Harris. Judging from these lists, one might conclude there will not be much difference between the companies when it comes to a question as to which shall secure a lighting contract.

THE COMBINATION PLAN AT COLUMBUS, GA.—Messrs. T. E. Blanchard, A. Dexter, E. H. Jenkins, W. L. Cark and D. F. Wilcox—all of whom are interested in the Columbus Gas Company—recently petitioned the City Council for the right to erect and operate an electric lighting plant in that city. The required consent was granted, and the necessary steps are now being taken to have the plant ready for business on Dec. 1. The gas men intend to supply both arc and incandescent lamps. Three circuits have been arranged for, the first to be closed at 9 P.M.; the second at midnight; the third at 6 A.M. More work for Bro. Jenkins.

ELECTRIC ECCENTRICITIES AT NEW ORLEANS, LA.—Elsewhere we chronicle the death of a lineman, caused by a shock from an electric light wire. This occurrence was supplemented, at a later hour of the same day, by the following list of electric eccentricities: The roof of the St. Charles Theater caught fire from an electric wire; the hat store of Fox & Hire, and Redwitz's saloon, suffered slight damage from a similar cause; and the cornice of the building occupied by the "Chess, Checkers and Whist Club," as well as the gallery of Cassidy's Hotel were also singed. While the damage in each case were comparatively slight, the happenings, nevertheless, go to emphasize the necessity for watching the wires pretty closely.

IMPROVEMENTS ON THE STAMFORD (CONN.) PLANT.—Acting under instructions from Treas. Gay, Supt. Miller, during the past summer, carried out plans that have resulted in placing the Stamford plant in position to meet the demand that will be made on it during the coming winter. An extension of 35 feet to the retort house enabled the placing of a new bench of 6's, and also guarantees room for a similar sample of benchwork next year. The Company intends to construct a gasholder (to have a capacity of about 60,000 cu. ft.) in the spring of '88. The Company's business steadily increases.

THE CANDLE POWER.—From the report of the local Gas Inspector, we learn that the illuminating value of the gas supplied by the San Francisco Gas Light Company averaged, during the month of September, 20.17-candle power. The same official reports an average of 20.35 candles for the gas furnished by the Pacific Gas Improvement Company.

PUBLIC LAMPS, CHICAGO, ILLS.—Chicago has 20,034 public lamps, of which 14,569 burn gas.

NO GASOLINE IN BUFFALO'S GAS.—A fortnight ago, when reporting the figures that had been submitted by the various lighting companies, in response to the Council's demand for proposals for the public lighting of Buffalo, N. Y., we noted that Councilman White thought the gas companies were addicted to the practice of "mixing gasoline with the gas supplied to the public lamps." In order to clear up the doubt the city chemist—Mr. F. P. Vandenberg—was instructed to determine whether or not the Councilman's charge was founded on fact. Mr. Vandenberg carried out the order, and reports that the gas supplied is fully up to the required standards of purity and candle power.

ELECTED.—Capt. J. B. Parrmore has been elected President of the South Florida Gas and Electric Light Company, of Orlando, Fla.

WELL!—Corporation Counsel O'Brien has rendered an opinion to the effect that the gas mains, whenever such conduits interfere with the electrical subways now in process of construction(?) in this city, must be removed by the gas companies.

IN FAVOR OF PLAINTIFF.—Something over a year ago J. M. Gordon entered into a contract with the Louisville (Ky.) Gas Light Company to take all the ammonia that would be produced in its works, the agreement to last for 5 years. At the end of the first year Gordon refused to continue, and the Company entered suit for damages. The case was tried in the United States District Court, before a jury, who rendered for the plaintiff, assessing the damages at $4,500.

REORGANIZED.—The plant and franchises of the Middletown (Ohio) Gas Light and Coke Company, recently sold at public sale, were purchased by a syndicate of local business men. Organization was effected by the election of Simon Goldman, President, and Geo. N. Clapp was made Manager and Superintendent. We understand the Company's capital is $24,000.

CHEAPER GAS FOR SAN ANTONIO, TEX.—Mr. R. C. Morton, Secretary of the San Antonio Gas Company, has notified "San Antone's" residents that, until further notice, they are to have their gas bills made out on the basis of $3 per thousand. We think this is a reduction of 25 cents per thousand.

ONALASKA, WIS., is to be lighted with gas from the mains of the La Crosse Gas Light Company. These points are about 5 miles apart.

NEW GAS COMPANY.—W. L. Whitaker and associates have secured the exclusive right (to run 20 years) to furnish gas to the city and citizens of Texarkana, Ark. Capital, $53,000. This place is the capital of Miller county. It is 145 miles southwest of Little Rock, and 222 east by north of Dallas, Tex. It is on the line of the T. & P. Railroad, and is the southern terminus of the St. Louis and Iron Mountain Road. Population, about 5,000.

AN ITEM FROM TREMONT, NEB.—The Tremont Gas and Electric Light Company is putting in a 50 light plant—lights to have an illuminating value of 2,000 candles each—of the American Company's type. It is intended to have the plant in operation by December 15.

IT is claimed that Bob. Ingersoll is one of the incorporators of the Standard Gas Light Company, whose proposed field of operation is Cheyenne. Evidently the noted unbeliever is at last convinced that mining securities are risky properties, despite Col. Jno. Dell's experience to the contrary.

PUBLIC LIGHTING AT BUTTE, MONTANA.—The electricians have had control of the public lighting of Butte City for some time back, but at present it seems as if the Gas Company is to be granted a chance. The city is lighted now by means of 13 arc lights of the 2,000-candle power type, the total annual cost thereof being $3,120—pretty high? At a recent meeting of the Council the Gas Company offered to supply 100 or more gas lamps (5-foot burners), and to light, extinguish, and clean the same for the sum of $2.50 each per month—moonlight schedule, and contract to run for 5 years. The electricians offered to maintain 20 arcs—moonlight schedule, contract to run for 3 years—they to receive $18 per month for each lamp. In the discussion that followed, Mayor Kenyon advocated a slight amendment—it referred to the locating of the gas lamps—to the Gas Company's proposition, which the latter accepted. The City Clerk was then instructed to draw up a contract with the Gas Company, the same to be submitted to the Council for ratification at a special meeting to be held on the next evening.

ONEIDA (N. Y.) citizens are complaining of the inefficient way in which the electric lighting of that place is being performed.

[Official Report.]

Fifteenth Annual Meeting of the American Gas Light Association.

Held at Dockstader's Hall, New York City, Oct. 19, 20, and 21.

First Day—Morning Session—Oct. 19.

The Convention was called to order by the President, Mr. M. S. Greenough, of Boston, Mass. On motion of Mr. Slater the minutes of the last annual meeting were adopted as published in the Journal.

ROUTINE BUSINESS.

The following applications for membership were received:

Bierce, F., Memphis, Tenn.
Brown, E. C., Phila., Pa.
Frost, E. I., New York city.
Glasgow, A. G., Phila, Pa.
Howard, E., New York city.
Houston, W. B., Rahway, N. J.
Jackson, W. M., New York city.
Krumholz, J., Buffalo, N. Y.
Lucas, Jr., P., Mt. Vernon, N. Y.
Lenz, E., New York city.
Morgans, W. H., Pontiac, Mich.
Milsted, W. N., New York city.
Murphy, J. M., Chicago, Ills.
Mooney, W., New York city.
Peters, M., Brockton, Mass.
Quinn, A. K., Newport, R. I.
Russell, D. R., St. Louis, Mo.
Snow, W. H., Holyoke, Mass.
Stephens, G., Tarrytown, N. Y.
Scriver, J. F., Montreal, Can.
Stacey, W., Cincinnati, Ohio.
Scrafford, W. H., Bath, N. Y.
Tilden, W. D., New York city.
Wagner, L., Phila., Pa.
Whittier, C. R., New York city.
Ward, G. M., New York city.
Wilcox, W. K., Middletown, N. Y.
Waldo, J. A., Boston, Mass.
Zimmermann, W. F., Pittsburgh, Pa.

The names were referred for consideration to a special committee consisting of Messrs. A. M. Norton, T. C. Cornell, and G. B. Neal.

Roll Call.

The following members were present:

Honorary Members.

Prof. H. Morton, Hoboken, N. J.
Prof. E. G. Love, New York, N. Y.
Robt. P. Spice, London, England.

Active Members.

Allen, A. L., Poughkeepsie, N. Y.
Amory, Dr. R., Brookline, Mass.
Andrew, J., Chelsea, Mass.
Atwood, H. A., Plymouth, Mass.
Balmore, J., New York, N. Y.
Baumgardner, J. H., Lancaster, Pa.
Baxter, I. C., Evansville, Ind.
Baxter, R., Halifax, N. S.
Baxter, W. H., Petersburg, Va.
Benson, F. S., Brooklyn, N. Y.
Beal, W. R., New York, N. Y.
Blodget, C. W., Brooklyn, N. Y.
Boardman, A. E., Macon, Ga.
Borgner, C., Philadelphia, Pa.
Bradley, W. H., New York, N. Y.
Bredel, F., New York, N. Y.
Brown, T. R., Philadelphia, Pa.
Bush, J. S., New York, N. Y.
Butterworth, W. C., Rockford, Ills.
Byrne, T. E., Brooklyn, N. Y.
Cadwell, W. D., Nashua, N. H.
Cartwright, J., Poughkeepsie, N. Y.
Cartwright, M., Rochester, N. Y.
Cartwright, W., Oswego, N. Y.
Clark, Walton, Chicago, Ills.
Coggshall, H. F., Fitchburg, Mass.
Cole, T. W., Altoona, Pa.
Connelly, J. S., New York, N. Y.
Connelly, T. E., New York, N. Y.
Copp, A. M., Boston, Mass.
Corbett, C. H., Brooklyn, N. Y.
Cornell, T. C., Yonkers, N. Y.
Cowdery, E. G., Milwaukee, Wis.
Coyle, P., Boston, Mass.
Crafts, D. W., Northampton, Mass.
Cressler, A. D., Fort Wayne, Ind.
Curley, T., Wilmington, Del.
Cushing, O. E., Lowell, Mass.
Davis, F. J., Waltham, Mass.
Dell, J., St. Louis, Mo.
Denniston, W. H., Pittsburgh, Pa.
Diall, M. N., Terre Haute, Ind.
Dickey, C. H., Baltimore, Md.
Dickey, R. R., Dayton, Ohio.
Dingee, F. A., Phila., Pa.
Down, W. H., New York, N. Y.
Edgerton, H. H., Phila., Pa.
Edwards, G. B., New York, N. Y.
Elkins, W. L., Jr., Phila., Pa.
Faben, C. R., Jr., Toledo, O.
Fay, W. J., Denver, Col.
Findlay, J. H., Ogdensburg, N. Y.
Flemming, D. D., Jersey City, N. J.
Floyd, F. W., New York, N. Y.
Floyd, H. E., New York, N. Y.
Floyd, J. R., New York, N. Y.
Foster, T. G.; Montgomery, Ala.
Fowler, J., Phila., Pa.
Frost, W. H., Baltimore, Md.
Gardner, J., Jr., Pittsburgh, Pa.
Gates, F. W., Hamilton, Ont., Can.
Geggie, D. H., Quebec, Can.
Gerould, C. L., Brooklyn, N. Y.
Gerould, L. P., Manchester, N. H.
Gilbert, T. D., Grand Rap., Mich.
Goodwin, W. W., Phila., Pa.
Gordon, J. J., Cincinnati, O.
Graeff, G. W., Jr., Phila., Pa.
Greenough, M. S., Boston, Mass.
Gribbel, J., New York, N. Y.
Griffin, J. J., Phila., Pa.
Hallett, J. L., Springfield, Mass,
Harbison, J. P., Hartford, Conn.
Helme, Wm., Phila., Pa.
Hookey, G. S., Augusta, Ga.
Hopper, W. H., Germantown, Pa.
Horry, W. S., Phila., Pa.
Humphreys, A. C., Phila., Pa.
Humphreys, C. J. R., Lawr'nce, Mass.
Huntington, P. W., Columbus, O.
Isbell, C. W., New York, N. Y.
Jones, E. C., Boston, Mass.
Jones, S. L., Phila., Pa.
King, E. J., Jacksonville, Ills.
Kitson, A., Phila., Pa.
Kraft, G. W., Phila., Pa.
Kreischer, G. F., New York, N. Y.
Lansden, T. G., Washington, D. C.
Leach, H. B., Taunton, Mass.
Learned, E. C., New Britain, Conn.
Learned, W. A., Newton, Mass.
Lindsley, E., Cleveland, Ohio.
Loomis, B., Hartford, Conn.
Lowe, L. P., Phila., Pa.
Ludlam, E., Brooklyn, N. Y.
Mayer, F., Baltimore, Md.
McCullough, E. H., Phila., Pa.
McDonald, W., Albany, N. Y.
McElroy, J. H., Pittsburgh, Pa.
McIlhenny, J., Phila., Pa.
McMillin, E., Columbus, Ohio.
Merrifield, P. S., New York, N. Y.
Merrick, S. V., Phila, Pa.
Monks, R. J., Boston, Mass.
Murphy, H., Sing Sing, N. Y.
Neal, G. B., Boston, Mass.
Nettleton, C. H., Birming'm, Conn.
Nettleton, C., New York, N. Y.
Norton, A. M., Nashua, N. H.,
O'Brien, W. J., Phila., Pa.
Page, G. S., New York, N. Y.
Gardner, Wm., Pittsburgh, Pa.
Park, W. K., Phila., Pa.
Parrish, W., Seneca Falls, N. Y.
Pearson, W. H., Toronto, Ont.
Perkins, J. D., New York, N. Y.
Pratt, John C., Boston, Mass.
Prichard, C. F., Lynn, Mass.
Ramsdell, G. G., Vincennes, Ind.
Richardson, F. S., N. Adams, Mass.
Robinson, W. L., Uniontown, Pa.
Roots, D. T., Connersville, Ind.
Seaverns, F., New York, N. Y.
Sherman, F. C., New Haven, Conn.
Slade, J., Yonkers, N. Y.
Slater, A. B., Providence, R. I.
Smallwood, J. B., Baltimore, Md.
Smedberg, J. R., Baltimore, Md.
Smith, M., Wilkes Barre, Pa.
Spaulding, C. S., Brookline, Mass.
Sprague, C. H., Boston, Mass.
Stanley, I. N., Brooklyn, N. Y.
Stedman, W. A., Newport, R. I.
Stein, E., Phila., Pa.
Stiness, S. G., Pawtucket, R. I.
Taber, R. B., New Bedford, Mass.
Townsend, S. S., New York, N. Y.
Turner, T., Charleston, S. C.
Vanderpool, E., Newark, N. J.
Warmington, G. H., Cleveland, O.
Watson, C., Camden, N. J.
Watrous, V. S., Little Falls, N. Y.
Weber, A., New York, N. Y.
Weber, O. B., New York, N. Y.
White, C. A., New York, N. Y.
White, W. H., New York, N. Y.
Willetts, C. A., Flushing, N. Y.
Wood, A. C., Syracuse, N. Y.
Wood, G., New Bedford, Mass.
Zollikoffer, O., New York, N. Y.

On motion of Mr. McMillin the regular order of business was modified so as to permit of the reception of reports of officers and standing committees.

Report of Treasurer and Secretary.

Secretary and Treasurer Humphreys presented the following annual report for year ending Sept. 30, 1887:

Receipts.

Initiation fees	$410 00	
Dues for year 1883	10 00	
" " 1884	20 00	
" " 1885	85 00	
" " 1886	260 00	
" " 1887	1,080 00	
" " 1888, in advance	5 00	
Sale of "Proceedings"	12 00	
Interest	87 79	
Total receipts	$1,969 79	
Cash brought forward from last year	2,202 59	
Total amount to debit		$4,172 38

Expenditures.

Printing Vol. 7 of "Proceedings" and mailing same	$918 35	
Salary of Secretary and Treasurer	500 00	
Expenses of Philadelphia meeting	81 35	
Printing, stationery, postage, and sundries	234 96	
Total expenditures	$1,734 66	
Cash carried forward to next year	2,437 72	
Total amount to credit		$4,172 38

Memo. of cash on hand:

Deposit in South Brooklyn Savings Inst.	$1,194 71
" Williamsburgh Savings Bank	805 60
" Lawrence Savings Bank	368 08
" Nat. Pemberton Bank of Lawrence	61 15
Cash in Treasurer's hands	8 18
Total	$2,437 72
Due from members, including year 1888	$1,915 00

Examined and found correct. C. H. Nettleton, A. E. Boardman, } Finance Committee.

The roll call for the year shows as follows:

Honorary Members.

Number on the roll Sept. 30, 1886		6
Admitted Oct., 1886		1
On roll Oct. 1, 1887		7

Active Members.

Number on the roll Oct. 1, 1886	281	
Admitted Oct. 1886	41	
		322
Resigned	10	
Died	2	
Number on roll Oct. 1, 1887	310	
		322

Deceased Members.—H. H. Fish, Utica, N. Y.; J. H. Walker, Sr., Tonawanda, N. Y.

The document was ordered to be placed on file.

REPORT OF EXECUTIVE COMMITTEE.

NEW YORK, OCT. 18, 1887.

To the Members of the American Gas Light Association: Gentlemen—Your Executive Committee would respectfully offer the following report:

The following papers, to be read at the present Convention, have been approved by the Executive Committee:

"Fuel Gas," by Emerson McMillin, of Columbus, Ohio; "Illumination *vs.* Candle Power," by Alex. C. Humphreys, of Philadelphia, Pa.; "Utilization of Residual Products," by C. H. Nettleton, of Birmingham, Conn.; "The Advantages of Gas Companies Engaging in the Electric Light Business," by E. J. King, of Jacksonville, Ill.; "Water Gas," by Walton Clark, of Chicago, Ill.; "Development of the Half-Depth Regenerative Furnace and Some of the Results," by O. B. Weber, of New York; "The Comparative Illuminating Power of Gas Purified with Lime *vs.* Oxide of Iron," by C. W. Blodget, of Brooklyn, N. Y.; "Disadvantages Occasioned by Fluctuations of Candle Power in Gas Furnished to Consumers," by Richard J. Monks, of South Boston, Mass.; "The Advantages of Regenerative Furnaces for Large and Small Gas Works," by Fred. Bredel, of New York city; "Purification Puzzles," by Thomas Turner, of Charleston, S. C.; "The Relation of Intensity of Light and Visual Perception," by E. C. Jones, of Boston, Mass.; "The Use and Value of Coke for Generating Steam," by J. L. Hallett, of Springfield, Mass.

Your Committee would recommend that at the present meeting the President's address be read after the reports of officers and committees.

At the last meeting of the Association the following amendment to the Constitution was offered, namely, to amend Article IV. by striking out the words "or engaged in industries relating thereto." Under the rule, this proposed amendment was referred to the Executive Committee. Your Committee recommends that the amendment be adopted.

A resolution was also passed at the last meeting requiring the Executive Committee to submit to the Association such other amendments to the Constitution as might be thought wise. Your Committee, therefore, submits to the meeting the amended form of Constitution accompanying this report, as a basis upon which a more perfect Constitution can be built up.

In regard to the resolution upon the matter of Gas Commissions, which was considered at the last meeting of the Association and referred to the Executive Committee, your Committee would report that it is inexpedient to take action upon the subject.

Form of New Constitution Proposed by Executive Committee.

I.—*Name.*

1. The name of this Society shall be The American Society of Gas Engineers.

II.—*Object.*

2. The object of this Society shall be the promotion and advancement of knowledge, scientific and practical, in all matters relating to the construction and management of gas works, and the manufacture, distribution and consumption of gas.

3. The establishment and maintenance of a spirit of fraternity between the members of the Society, by social intercourse, and by friendly exchange of information and ideas on the before-mentioned subject matters.

4. The inducement and extension of more cordial and friendly relations between the manufacturers of illuminating gas and their patrons, based upon the mutuality of interests.

III.—*Members.*

5. The members of this Society shall consist of three classes—Ordinary Members, Honorary Members, and Associates.

6. To be eligible as an Ordinary Member, a person must be a president, vice-president, director, secretary, treasurer, engineer, consulting engineer, or superintendent of a gas company, or an individual manager of a gas works.

7. Associates shall be persons holding a responsible position in a gas works, or persons whose pursuits constitute branches of gas engineering, or who are otherwise qualified to assist in promoting the objects of the Society.

8. Honorary Members shall be gentlemen whose scientific or practical knowledge in matters relating to the gas industry, and whose efforts and interest in that behalf shall recommend them to the Society.

IV.—*Election of New Members.*

9. Every application for membership shall be made in writing to the Secretary, indorsed by the Ordinary Members, or Ordinary Members and Associates, and must be accompanied by a statement in writing of the grounds of the application, and an agreement that he will conform to the requirements of membership if elected. The Secretary shall, thereafter, submit the application to the council to be considered, and, if approved by them, it shall be brought before the next meeting of the Society.

Application shall be made upon a printed form supplied by the Society, and shown in Schedule A, appended to these rules.

10. The preceding rule shall apply equally to any person soliciting admission as an Associate, application to be made upon a form, as shown in Schedule B, appended to these rules.

11. It shall be competent for any Associate to apply to the Secretary to be transferred from the class of Associates to that of Members. Such application shall be submitted to the council, who may, if the applicant is eligible to membership, recommend the transfer for approval at the next meeting of the Society, the application to be made on a form to be supplied by the Society, as shown in Schedule C.

12. Application for Ordinary Membership, or for Associate Membership, or for transfer from Associate to Ordinary Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.

13. Honorary Members shall be proposed by the council, at a general meeting of the Society.

14. An applicant for admission to any class of membership, or for transfer from one class to another, must receive the votes of two-thirds of the members present to be elected.

15. If any person, proposed for admission to the Society, or for transference from the class of Associates to that of Ordinary Members, be rejected, no notice shall be taken of the proposal in the minutes.

16. Any persons elected to the Society, excepting Honorary Members, must subscribe to the rules and pay to the Treasurer the initiation fee before he can receive a certificate of membership. If this is not done within six months of notification of election, the election shall be void.

V.—*Management.*

17. The affairs of the Society shall be managed by the council, subject to the control of the general meeting.

18. The Council shall consist of the President, three Vice-Presidents, eight Ordinary Members, and the President or acting President of the preceding year. The Secretary shall also be, *ex-officio*, a member of the Council. Five members shall constitute a quorum.

19. The Council shall appoint from their own number, immediately after the meeting at which they are elected, a Finance Committee of three members.

VI.—*Election of Officers.*

20. The President, Vice-Presidents, Secretary and Treasurer shall be elected annually.

21. Four Ordinary Members of the Council shall retire each year.

22. All elections shall be by ballot.

23. The President and the four retiring Ordinary Members of the Council shall not be eligible for election the following year.

24. Previous to each annual meeting it shall be the duty of the Council to appoint a Nominating Committee of five members. It will be the duty of the Nominating Committee to present at the annual meeting a list of Ordinary Members, whom they recommend as office bearers for the ensuing year.

25. No member of the Council shall be eligible as a member of the Nominating Committee.

26. The Council shall have power to fill vacancies in its own body.

VII.—*Duties of Office Bearers.*

27. The office bearers shall assume office immediately after the meeting at which they have been elected,

28. The President shall take the chair at all meetings of the Society or committees at which he is present.

29. In the absence of the President one of the Vice-Presidents shall take the chair, and in the absence of the President and Vice-Presidents a Chairman shall be appointed from among the other members of the Council.

30. The duties of the Secretary shall be to take minutes of all proceedings of the Society, and of the Council, and enter them in proper books for the purpose. He shall conduct the correspondence of the Society, read minutes and notices of all the meetings, and also papers and communications, if the authors wish it, and perform whatever duties may be required in the Constitution and By-Laws appertaining to this department.

31. The duties of the Treasurer shall be to receive and keep all annual dues and funds of the Society, to keep correct accounts of the same, and pay all bills approved by the President or a member of the Finance Committee, and he shall make an annual report to be submitted to the Society.

32. The duties of the Finance Committee shall be to audit the books, accounts and statements of the Treasurer; to invest the funds of the Society, and to care generally for the finances of the Society, subject to the control of the Council.

33. The duties of the Council shall be to have the general management of the affairs of the Society, to designate the writers of papers at each meeting, and the subjects to be discussed, and to prepare for the meetings of the Society. The Council shall have the power to appoint, from time to time, a Committee of Arrangements from among the members to assist the Council in arranging for the meetings of the Society.

VIII.—*Meetings and Proceedings.*

34. The annual meeting of the Society shall be held on the third Wednesday of October of each year, at 10 o'clock A.M., at such place as shall be designated by the Society at the previous meeting.

35. At the annual meeting of the Society the order of business shall be: (1) The reading of the minutes of the last meeting; (2) the report of the Council on the applications for membership, and for transfer of membership; (3) the election and introduction of new members; (4) the address of the President; (5) the report of the Council on the management of the Society during the previous year; (6) the report of the Treasurer and of the Secretary; (7) reports of special committees; (8) election of officers; (9) reading of papers, and discussion on the same; (10) general business.

36. At other general meetings of the Society the order of business shall be the same, except as to the 5th, 6th, and 8th clauses.

37. The Secretary shall send notices to all members of the Society at least fourteen days before each general meeting, mentioning the papers to be read, and any special business to be brought before the meeting.

38. Special meetings may be called at the option of the Council, and the Secretary shall call a special meeting on the written request of 20 members. The notices for special meetings shall state the business to be transacted, and no other shall be entertained.

39. Thirteen members shall constitute a quorum.

40. All questions shall be decided by any convenient system of open voting, the presiding officer to have a second or casting vote when necessary.

41. Questions of a personal nature shall be decided by ballot.

42. Any member, with the concurrence of the presiding officer, may admit a friend to each meeting of the Society, but such person shall not take part in any of the discussions unless permission to do so be given by the meeting.

43. All papers read at the meetings of the Society must relate to matters either directly or indirectly connected with the objects of the Society, and must be approved by the Council before being read.

44. All papers, drawings, or models submitted to the meeting of the Society shall be and remain the property of the authors.

45. The Council shall meet before each general meeting of the Society, and on other occasions when the President shall deem it necessary. Of such special meetings reasonable notice shall be given by special call, in print or writing, specifying the business to be attended to. The President shall be requested to call the Council together on the written request of 5 members of the same.

IX.—*Privileges and Duties of Members.*

46. Every person elected as an Ordinary Member shall pay an initiation fee of $10, which shall include the dues for the current year.

47. Every person elected as an Associate Member shall pay an initiation fee of $10, which shall include the dues for the current year.

48. Every Ordinary Member shall pay annually, in advance, the sum of $5.

49. Every Associate Member shall pay annually, in advance, the sum of $5.

50. Honorary Members shall not be required to pay an initiation fee, nor annual dues.

51. No member who owes for two year's dues shall be entitled to vote, or to participate in the deliberations of the Society, or to receive a copy of the proceedings.

52. Any member may retire from membership by giving written notice to that effect to the Secretary, and the payment of all annual dues to date, unless released from said payment by a vote of the Council. Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll of membership by a vote of the Council.

53. A member dropped from the roll for non-payment of dues may, upon paying the amount he owes the Society, be reinstated at the option of the Council.

54. Any member may compound for his annual payments by paying $50 in one sum.

55. Each member of the Society shall be furnished annually, by the Secretary, with a copy of the proceedings of the Society and the Constitution, and also a list of the names and address of the members.

56. A member may be expelled from the Society by a recommendation to that effect made by the Council, at any general meeting of the Society. The vote shall be by ballot, and shall require two-thirds of the votes cast for its adoption.

57. An Associate Member will be entitled to all the privileges of the Society, except voting for and holding office.

58. An Honorary Member will be entitled to all the privileges of the Society, except voting for and holding office.

Amendments.

59. All propositions for adding to or altering any of the provisions of the foregoing Constitution shall be laid before the Council, who may bring it before the next general meeting of the Society, if they see fit, and the Council shall be bound to do so on the requisition, in writing, of any five members of the Society.

Discussing the Report.

The President—The recommendations of the Executive Committee will now be taken up separately and debated by the Association before action is taken upon them. The first recommendation is that referring to the proposed amendment to Article IV. of the Constitution. The Secretary will read Section IV. as it now stands.

The Secretary (reading)—"To be eligible as an Active Member a person must be a president, vice-president, director, secretary, treasurer, engineer, consulting engineer, or superintendent of a gas company, or an individual manager of a gas works, or a person practically skilled in the construction and management of gas works, or engaged in industries relating thereto."

The President—It will be seen that the object of this amendment is to somewhat raise the qualifications which it is necessary to possess to become a member. The motion was made, I think by Mr. Stiness, that the words "or engaged in industries relating thereto" be stricken out; and this would render people who are simply engaged in industries connected with the profession ineligible as Active Members of this Association.

Mr. Harbison—Perhaps it would be well to further state that it is not the object of the Executive Committee to rule out from membership in the Association gentlemen engaged in industries connected with gas interests, for in the new form of Constitution proposed provision is made for *Associate* Members; hence gentlemen who are indirectly connected with the gas interests could become Associate Members, but not Active Members, although they can enjoy all the privileges of active membership save in the matters of voting and holding office.

The President—A request was made at the last session that the Executive Committee submit to the Association such other amendments to the Constitution as in their opinion might be wise. On the strength of that request the Executive Committee have reported a new Constitution altogether; and this proposed Constitution provides for two classes of members. Of course the new Constitution cannot be acted upon at this meeting; and there is no desire to do so. It will be presented to the Association, and will be considered by the members during the coming year. I presume it will be referred to the Executive Committee in the natural order of business, and next year will come before us for final action. The applications for membership which are now before the Association will not be at all affected by the passage of the amendment which is now proposed. They will come in under the old rule. But if this amendment is adopted, gentlemen who are simply engaged in some of the industries related to our business will not, next year, be eligible to

active membership. The Secretary will read the corresponding sections of the proposed new Constitution.

[The Secretary thereupon read paragraphs 5, 6 and 7, as published above.]

Mr. Slater—I suggest that action be taken now on the amendment to Article IV., and that we afterward take up the new matter.

The President—I made the explanation in order that the Association might understand what was the intention of the Executive Committee. The question now before the Association is on the proposed amendment to Article IV.

Mr. McMillin—May we not get into trouble by voting on that amendment, particularly if it is adopted? I believe it was the intention of the Executive Committee, in reporting this, not to exclude any applicants for membership at this meeting. Applications have been made and referred to the Committee, and that Committee has not yet reported. If we now adopt this amendment, and before that Committee reports, we may not be able to elect to membership some whose applications may be favorably reported upon.

On motion of Mr. Amory the amendment was laid on the table, to be taken therefrom when the Committee on Applications for Membership presented their report.

The New Constitution.

The President now called attention to the draft of the new Constitution submitted by the Executive Committee. On motion of Mr. Harbison the matter was referred back to the Committee, they to report thereon at the next annual meeting.

Gas Commissions.

On motion, the recommendation of the Executive Committee in regard to gas commissions was indorsed.

Report of Finance Committee.

The report of Finance Committee was received, read and ordered placed on file.

Report of Committee on Uniformity of Meter Connections.

Mr. Sherman, on behalf of the above-named Committee, read the following report:

"The Committee to whom was referred the matter of uniformity in meter connections respectfully recommend that the members of this Association adopt the unions of the American Meter Company, of New York city, as their standard. The Committee would take this time to express their obligations to the meter manufacturers for their samples of unions and valuable suggestions."

A lengthy debate ensued on the report, the conclusions reached being the following: The report was tabled, and a motion (by Mr. Amory) was adopted to appoint a new Committee (to consist of representatives of the various meter manufacturing firms) to investigate the subject, the Committee to report, if possible, at the present meeting. In conformity with the resolution President Greenough appointed the following: Messrs. W. H. Down, New York city; W. W. Goodwin, Phila., Pa.; J. J. Griffin, Phila., Pa.; Wm. Helme, Phila., Pa.; J. B. Smallwood, Baltimore, Md.; and Nath. Tufts, Boston, Mass.

Election of New Members.

Mr. Neal, of Committee on Applications for Membership, presented a report favoring the election of those whose names had been submitted to them for consideration. The report was accepted. The Secretary was instructed to cast the ballot of the Association in favor of the election of the nominees. The latter were then welcomed to seats in the Convention.

At this point Honorary Member Mr. R. P. Spice (London, England) entered the hall, and, amidst loud applause, was escorted to a seat on the platform.

Amending Article IV. of the Constitution.

The President now reverted to the recommendation of the Executive Committee—it had been tabled to facilitate the election of applicants for membership at the present session—in regard to striking out the words "or engaged in industries relating thereto" from Art. IV. of the Constitution. On motion (Mr. Harbison) the recommendation was adopted.

PRESIDENT'S ADDRESS.

President Greenough then delivered the following address:

Gentlemen of the American Gas Light Association:—The first and most agreeable duty which falls to your presiding officer is that of welcoming you all to another meeting, and congratulating you upon the year's prosperity which the companies that we represent have almost without exception enjoyed. There are few industries in existence which for so many years in the past have afforded a safe investment to the capitalist and trustee. Whether this will be so in the future depends to a great extent upon the members of our profession here and abroad.

If we accommodate ourselves to the new demands which are now made upon us, and meet with cheaper or better light our various competitors in the race for public favor, then gas will continue to yield a fair profit to the genuine investor. If we do not, the consequences can easily be foreseen. The time has gone by when a gas company could charge such a price as would yield them the profit they desired and collect it without difficulty. The time has come when the price must be fixed to get the business and the profit looked for afterwards. By diligent searching, however, I think we shall be able to find it.

It is also a matter for congratulation that during the past year the inroads of death have been so small among us. We have left but few of our friends by the wayside in our march through life this year. With but two exceptions the Association remains intact, and I speak, I know, the general sentiment when I express my great and thankful satisfaction that our friend, Mr. Denniston, was not killed in that recent terrible disaster in Ohio. The gentlemen who have gone from among us, Mr. Fish, of Utica, and Mr. Walker, of Tonawanda, will be much regretted, and I trust the Association will take suitable action at this meeting in regard to them.

The second duty, which I shall try to perform, will be that of briefly reviewing various matters which have been brought prominently to our attention during the past year, and I shall then devote a few minutes to some subjects directly concerning our Association.

Undoubtedly the question which has been more than any other in the minds of most of us is the future of electric lighting, and the policy of gas companies with regard to it. We are all familiar with numbers of patents which have each promised to wholly revolutionize existing methods of gas making, and which gradually subsided like heaving waves of the sea, leaving no more effect upon our method of doing business than has been produced upon a rocky coast by the waves breaking against it. We have also seen an unreasoning terror of electric light seize with panic the holders of gas stock, and cause them to part for a low price with stock which to-day is more valuable than ever. As a result of these experiences the stockholder has grown, perhaps, too bold, and after an uncalled for fear of the threats of his electric rival, he has not unnaturally passed into a defiant frame of mind, with entire confidence in the stability of his investment. It was, however, calculated to somewhat startle the strongest believer in gas to receive the circular from the Westinghouse Electric Lighting Company, which was sent a year ago to the gas companies of the country. In that document we were invited to abandon our business altogether so far as gas lighting was concerned, to turn our mains into conduits for fuel, and to furnish our customers with incandescent electric light as being the light of the future. Mr. Westinghouse is a man so well known throughout the world, of such indomitable energy and such financial success, that his name is a host in itself to the scheme he favors, and can command from his friends and followers the requisite capital to push it. You are to hear at this meeting a paper on the subject of the combination of gas and electric lighting, from a gentleman well versed upon the question, and I do not wish to say too much or I may be trenching upon his ground. You will also hear a paper on fuel gas, from one to whom we always listen with interest, so that that branch of the subject will require no detailed treatment at my hands. At the same time I should be unwilling to pass over this reference to the proposition of Mr. Westinghouse without expressing my disapproval of it. Far be it from me to underrate the value of the incandescent electric light. On the contrary, I am well known to have been favorably disposed to it for some time, and many gentlemen here will remember the criticism which I received at Providence, R. I., in 1886, for the advice* on the subject which I ventured to offer the New England Association. But there is a wide difference between supplying electric light to those who want it, and supplying nothing else. Before gas can be abandoned some other light must appear which is equally reliable and either better or cheaper. How are these requisitions filled by electricity? Better? yes; in some places. Cheaper? no; hardly anywhere. Equally reliable? not yet.

We hear a great deal of wiring new buildings for electric light, and we certainly see a great deal of it going into stores and theaters; but I fail to hear of buildings being erected without gas pipes also, nor is it customary to order out a gas meter when the wires are put up. People must have something to fall back upon which will not fail them. Perhaps the same may some day be said of electricity, but it will only happen when the wires are as securely buried and insulated as a gas main, and when a sufficient number of amperes are stored in various parts of the town, to prevent the lights going out in case of an accident to the

*See JOURNAL, Vol. XLIV., Mar. 2, 1886, p. 123.

generating station. It is perfectly true that people bear with some degree of equanimity an accident to their electric lights at present. They say that too much must not be expected of a new system, and cheerfully light their gas. Suppose, however, that the gas company abandoned its supply and turned over its pipes wholly to fuel, relying upon wires for light, and that then there should be the troubles which we occasionally have brought to our notice. I think the company and the public would both regret the change. So far the electric lamp has hardly penetrated the walls of private houses. From time to time I hear of some financial magnate who has put in a separate installation for his exclusive benefit, and I know of one station where a small number of neighbors are supplied from a storage battery into which the dynamo is continually working. Practically, however, the domestic lighting business is still untouched. To get this a light must be cheaply produced, which must either have less of that intense brilliancy which characterizes the ordinary lamp, or which must be so pleasantly shaded as to largely detract from its illuminating power. Still more important, however, is the question of reliability. It is all very well to attach as a novelty to a chandelier the glass globes containing the electric light, but when a steady and permanent use of a light is considered, it must be one for which gas can be abandoned. Now, this can unquestionably be done by the use of storage batteries upon a direct current, at a price. Whether it can be done at all upon an alternating current, such as the Westinghouse, remains to be proved. Perhaps so; but so far as I know it has not been. Upon a direct current it is feasible under certain conditions. In the first place, the storage batteries are very expensive, considering the uncertainty of their duration; and in the second, I am informed that they still are unsatisfactory. A battery should be like a gasholder. It should fill or empty itself as rapidly as may be desired, without injury or inconvenience; it should certainly give up in five hours the accumulations of the other nineteen, without any deleterious effects; but this, I am informed, has not yet been accomplished in practice. Probably it will be done—nothing seems impossible to an electrician, but when it is it will be at no trifling expense. In other words, putting aside the question of the quality of the light, which needs improvement, my conclusion is this—that if you want cheapness you lose reliability, and if you insist on reliability you lose cheapness. Now, some people want cheapness, some reliability, most people both. It has been said that literature is a good stick, but a poor crutch—very well to help along, but bad to depend upon in a pinch. So with incandescent electricity.

If there is a demand for electric light of one kind in stores and of another in houses, I know no reason why the same gas company should not furnish both; but I think there are very good reasons why it should continue to furnish gas as well. And let it not be understood that when I talk of cheapness in regard to electric light I believe that it can be supplied as cheap as the same amount of light is furnished by gas in most of our larger cities. It can certainly be furnished cheaper than at first, and the use of high tension alternating currents with reducers has undoubtedly been a step in that direction; but I do not see my way to believing that it can as yet approach the cost of gas in this city, light for light, nor even that in towns where gas costs somewhat more than here. If there is an incandescent electric lighting company which sells its light at a price equivalent to gas at $1.50 per thousand, and which pays dividends out of its earnings, I can only say that I have not heard of it. Gas, at that price, however, is unfortunately the exception and not the rule, and in very many of our smaller cities it is in the power of an electric lighting company to play the part of dog in the manger. It can prevent the gas company's making money without doing so itself. As in many other operations, the cost of running electric lights does not increase proportionately to the number in use, and it is, therefore, the policy of a small company to increase its business at almost any price, even at rates which not only exclude competition from gas, but which cannot return a new dollar for an old one. Under these circumstances the same alternative is presented as in the case of a competing gas company. The old one must settle or fight, and its policy must be governed to some extent by the character of the men who control the electric lighting company. If they act as did a company recently brought to my notice—put in a plant for $30,000, and ask $100,000 for it, the course of the gas company is plain; but if they are sensible men then I think a union of interests advisable. I am aware that this view is not universally held, but we are here for the purpose of comparing our ideas, and I trust that Mr. King's paper may elicit a full discussion.

Many members of our profession have been in hopes that they would be assisted in their business by an incandescent gas burner. The statement has been made, on good authority, that of the heat units in a gas flame only about 5 per cent. are utilized in light. I confess to having some doubts about the fact, but there is no doubt that if it is incorrect it is only a question of percentage, and that undoubtedly there is much more light in a foot of gas than has ever yet been got out of it. The development of the Siemens and other high-power burners is a step in this direction, though by a different road. By utilizing some of their own waste heat they greatly develop brilliancy; in fact, a brilliancy so great as to make the light unsuitable for domestic lighting. It has been, then, in an attempt to get the same amount of light from less gas, and not more light from the same amount of gas, that the work has been done that has attracted so much attention, both here and abroad, during the past six months. A steady light, almost white, producing much less heat than an ordinary gas flame, perhaps because only half the amount is burnt, seems a very attractive investment and a very powerful ally; but an examination of all the facts is sure to greatly dampen any premature enthusiasm.

It has been found in the Welsbach burner that the light, though beautiful when the incandescent mantle was new, deteriorated rapidly, and it was not very long before the gas with which it was heated yielded hardly more light per cubic foot than could be obtained from ordinary burners. It was also found that the mantle was so extremely friable as to render its domestic use almost out of the question, and as a result of these two radical defects it has practically been a failure in Germany, except that in Vienna it can be seen in limited use. It is fair to say that some of the people interested in this and kindred burners admit its defects, and are busily experimenting with a view to their removal; and when we remember how boundless are the limits of human ingenuity, and against what seemingly insurmountable difficulties our electric rivals have successfully struggled, it would be a foolish prophet who would undertake to say what can or cannot be done in this direction. It has become evident that success in this business means a fortune to all concerned, and many brains have been set working at it. Without much faith in the present burners on the market, I am not without some hope of the future; and when the day shall come that an incandescent gas burner shall burn 1,000 hours and still give a light of 8 candles per foot of gas, and that with this shall be combined a toughness which shall defy ordinary jars, then I shall feel that the gas companies have really found a friend.

In this connection also should be mentioned the efforts of Mr. Lowe, Mr. Fahnehjelm, and others, to utilize for incandescent light the heat-giving powers of pure fuel gas. Personally I have grave doubts about the success of such a gas, both on economical and sanitary grounds. I may, however, be wrong. The fuel of the future may turn out to be artificially-scented hydrogen and carbonic oxide, at least in factories; and if this shall prove to be the case there will certainly be a great opening for somebody who shall succeed in satisfactorily meeting the demand for cheaper light as well as heat. Whether it has yet been met or not by the inventions now on the market I am not prepared to say; but I confess to considerable skepticism at present.

There is only one more practical question on which I wish to speak. That is regenerative furnaces. It is a subject which will be discussed in two papers at this meeting; but I wish to express my opinion to the effect that the tendency is to spend less money to save waste heat. Since the attention of engineers has been called to the possibility of heating retorts with ever-decreasing percentage of fuel, they have steadily persevered in that direction, piling up ever-increasing quantities of tile, and making the systems more complete, but at the same time more complicated. Every additional air flue brought in close contact to the outgoing gases for the purpose of extracting heat from them furnishes another opportunity for leakage also; and nothing can be more exasperating, as well as costly, than the failure of elaborately constructed settings to do their work. Suppose that in a comparatively simple system the percentage of fuel is not over 25 per cent. by volume or 17 by weight, and that in an elaborate setting it is cut down to 12, the cost of one being double that of the other, then it is apparently a question only of the value of fuel in each locality. But if the simple system works more reliably than the other, and with the exercise of much less care and intelligence, then I think another factor is introduced which is well deserving attention. It is probably the case that this audience contains men who can assure us of the entire success in their works of the most elaborate systems yet devised; but I think that if human nature were as willing to avow its failures as its good fortunes, they would be outnumbered by other men who would tell a totally different story. A very little thing can spoil any system yet invented. Only the greatest care can insure the perfect construction and working of a first-class regenerative setting. I was in Europe for a short time this summer, and visited one day one of the largest stations on the Continent. The engineer informed me that they had used there several of the best systems of elaborate firing with good results. He also said that they had used one of the unpatented

systems of half-regenerative work with so great comparative success that he doubted very much their building any more of the other kind. This of course is only a straw showing how the breeze is blowing on other people as well as myself, but as such it is worth nothing; and I am inclined to the opinion that the furnace which will eventually come into general use will be one which does not aim at the highest possible results.

The number of new processes for making gas which are devised by inventive and not too scrupulous men has become so great that it is no wonder that interest has been taken by the managers of so many companies in the formation of what Mr. Egner has tentatively christened by the name of the Gas Institute. He has called my attention officially to the scheme, that I might recommend it, if I saw fit, to the favorable consideration of this Association. Upon mature reflection I am unable to do this; first, because I doubt very much its satisfactory working, and, second, because if combined action is advisable for the gas companies I think it can be obtained in a simpler and less expensive way. I think also that the name proposed for the enterprise is not a happy one. It would, I think, be much better to select one which had not already been chosen by the largest Association of Gas Managers in the world, to describe an institution so wholly different from that which it is now proposed to establish. The name, however, is of minor consequence, though I trust some other one will be selected if the scheme proposed should become an established fact.

Granting, then, that combined action by gas companies is advisable is there no way of obtaining it save by the appointment of a high-class expert and a corps of assistants, and their establishment with offices and laboratory in Washington or elsewhere? If this expert is to be of value, his judgment must be of the best, and his character so high that no possible suspicion may rest upon him of possessing interested motives when he recommends or disapproves of any particular scheme. There are such men to be found in this country, of course; but they are all busily engaged at good salaries, and I think it would be by no means easy to induce one of them to leave his present assured position and take at any reasonable salary a place of which the permanency seems so dubious, for I doubt there being business enough to occupy a man for more than half his time; and I do not believe that the plan if put in operation would prove sufficiently profitable to gas companies to induce them to subscribe for many years.

I think, however, that by the medium of this Association the same result may be obtained, and in a better way. The plan which I would suggest would be the election of a permanent Investigating Committee, who should be nominated after careful consideration of localities, and who should be assisted when called upon to act by such of their neighbors as should put their names on the Secretary's list as willing to serve as volunteers. Let us suppose that Mr. Slater was the New England member, Mr. Wood the New York, Mr. McMillin the Ohio, or anybody else you please. Suppose also that myself and a dozen other gas engineers of New England had signified our willingness to assist Mr. Slater whenever called on. Suppose, again, that the manager of some town in our neighborhood was approached by the representative of some patent process, valuable or otherwise, but on which he is unwilling to trust his own judgment. He calls upon Mr. Humphreys, who refers him to Mr. Slater. If Mr. Slater is himself in doubt, he calls in turn upon such of the nearest volunteers as he desires, and they jointly make an examination of the process, make their report to the manager of the gas company interested, a copy of it to the Secretary of this Association, and draw from him the amount of their expenses incurred. Transfer the locality to New York or Ohio, and with different people a similar scene would be enacted. In this way the member of this Association in need of advice would not only get the best to be had in his neighborhood, but the Association would also get at the end of the year a valuable and interesting mass of information, from which a useful report might be extracted. The expense might be $500 to this Society, though I should doubt it. If it were more it might be necessary to raise the assessment a trifle, if the value of the plan did not increase our members sufficiently to counterbalance it. As to serving on the committee, I think it would not be difficult to find candidates. Every man wishes to keep posted, and is desirous to learn about any new plan of making, distributing, or burning gas better. The number of occasions which he would be called upon would probably be small, and, I think, he could well afford the time. The number of volunteer aids whom he could summon would be, I think, nearly that of the Association.

I commend, then, this plan to the committee which I presume will be appointed to consider the President's address. Although in a crude form, and perhaps not fulfilling every requisite as a substitute for Mr. Egner's, I think it can be whipped into such a shape as to substantially do the work desired.

It is not remarkable that a demand should exist for educated assistance from the managers of smaller companies, for it is the experience of every person who has to do with engaging such, that it is hard to select, at the salary which can be paid, men who are competent to attend to all the varied details of a gas manager's work.

Although our large technical schools in Hoboken, New York, Troy, Boston and elsewhere are annually turning out scientifically educated young men, yet few of them know anything worth mentioning about gas; and when called upon to choose between the practical gas maker who works by rule of thumb, and the man of science who knows nothing in particular of the gas business, the employer is sure to select the former. Now, if there is any profession in the world which needs educated brains it is ours; and yet there are not enough of them in it. The amount of money invested in our business exceeds, I believe, that in any other except railroads, and yet its management is largely in the hands of men who lack a strictly technical education.

Often have I regretted myself, when listening to some glib scientific talker, that my education had not been thorough enough to enable me to detect what I believed to be his errors. A perfectly equipped gas manager should be both engineer and chemist, and besides that should have that technical knowledge of his profession for which many years of experience are the best teacher, but which a hard course of study can, to some extent, replace. When it has been sufficiently realized by the public that there is money in it, then very likely a special course may be given in some technical school, but at present I doubt that it would be appreciated, and I have been turning over in my head the possibility of some similar scheme to that adopted by the association of London Guilds. These ancient bodies have joined together for the purpose of technical examinations, not only for the trades which they once represented, but also for others. They do not teach, they simply examine; and workers in every industry come to London to get, or fail to get, a diploma, which they can show anywhere as a proof of their efficiency. Among the other examinations held is one for the office of gas manager. It is held by Mr. Robert Morton, formerly Engineer of the London Company, and the papers are prepared and examined by him. It is by no means easy to pass, and a considerable number of those offering are rejected. A young man who should come to me with a certificate that he passed with honor would impress me in the same way as would a young physician. His natural common sense could not, of course, be determined by any examination, and his information would be increased by a little experience; but a man possessed of thorough theoretical knowledge acquires experience rapidly. If there were some institution in this country of high repute which would take up this matter, I think very few holders of its diplomas would find themselves long out of work. I have nothing to suggest yet, for my only effort in this direction has been but a failure; but perhaps something may occur to one of my hearers from which results may eventually grow, and with that hope I commend it to your thoughts.

Among the other papers which we shall listen to at this meeting will be one on water gas. Although I know nothing of its contents we shall undoubtedly be interested in hearing it. Because this Association was founded by representatives of the older and more conservative companies, and because many of our members are still skeptical of some of the virtues attributed to water gas, yet we are all of us open to conversion. I probably am reputed myself to be as stubborn an opponent of it as there is, but I am none the less bent upon acquainting myself with the details of every new process brought out—its advantages and its weak points. Although the merit of economy can in many places be no longer claimed, yet some most ardent objectors to its use have received a change of heart owing to the influence of the Knights of Labor. No company can tell when they may be forced into its use, either wholly or as a supplementary system; and with this possibility before us I know no bett r place than the meetings of this Association to discuss all questions pertaining to the various processes. If the enthusiastic adherents of water gas——first, last and always—insist on withdrawing from their benighted fellows and getting up an association of their own, of course, the rest of us cannot help it; but I am sure I speak the sentiments of this body when I say that we should regret their action, and no matter where they go, or what society they found, I doubt their ever finding more interested auditors than here.

One thing more before I close. One of the weaknesses of human nature is a desire for decoration, and one of the evidences of this fact is the way in which most organized bodies take pleasure in ornamenting themselves with badges. To provide a simple and yet tasteful emblem of membership is always a tax upon the ingenuity and the pockets of those who arrange our meeting. If it is the desire of the Association to continue the custom of wearing something at our annual gatherings by

which members can be distinguished from outsiders, then I would suggest that a committee be formed to whom shall be committed the preparation of designs for a permanent badge, and that they be requested to submit these designs to the Secretary, with estimates of their cost, and that he then take the sense of the Society as to the one to be adopted. and order for the next meeting that number which the individual members agree to take and pay for. The only real necessity for conspicuous badges is upon the persons of the Committee of Arrangements at our annual excursion, and perhaps upon our Secretary. These might be easily provided. The rest of us can use some simple decoration, emblematic of our profession, and which I have full faith that we have among us sufficient ingenuity to design.

Gentlemen of the American Association :—"United we stand, divided we fall." The man who manages the business of his company, relying solely upon his individual experience and intelligence, can never keep up with the times. It is only by imparting to each other the results of our efforts to do better, no matter whether successful or not, and putting all our information into a common fund, that we can expect to prosper in the struggle before us. Hundreds of millions of dollars are invested in the business we represent, which it is our chief aim to protect. Nor can I better conclude than by reiterating my belief that if we are true to our duty the supply of gas will continue to be the chief source of modern light, and will yield a safe profit to the judicious investor. Strong in this opinion, I feel, of course, a firm confidence in the future of this Association, and a great desire for its prosperity.

Committee on President's Address.

Capt. White moved that a committee of three be appointed to consider the President's address, and report to the Association recommendations respecting such matters as are contained in the address which they might deem of special interest to the Association. The motion prevailed, and the Chair appointed as such committee Messrs. R. B. Taber, A. E. Boardman and G. G. Ramsdell.

Appointment of Special Committees.

The following special committees were appointed: *On Nomination of Officers*—Messrs. F. C. Sherman, A. C. Wood, T. G. Lansden and W. A. Stedman. *On Place for Holding Next Meeting*—Messrs. W. Clark, D. H. Geggie, and T. G. Lansden.

Invited to a Seat on the Platform.

Mr. Harbison—Mr. Barker, a member of the Massachusetts Gas Commission, is with us. I suggest that he be requested to occupy a seat on the platform during the meeting of the Association.

The President—We shall be glad to have Mr. Barker take a seat on the platform.

Mr. Barker—Thanking you, Mr. President and members of the Association, for the courtesy you have been pleased to extend to me, I trust I may not seem discourteous if I ask to be excused from appearing on the platform. I can assure you that I am very much pleased to be here. We have come to look upon the meetings of this Association with a great deal of interest; and I am sure that my associates in the Gas Commission would be pleased to be present with you were they not detained by other engagements. (Applause.)

Reading the Papers.

The President called upon Mr. Walton Clark to read his paper on

WATER GAS.

Mr. Clark read the following:

There are before the American gas public many systems of water gas making. As to their individual peculiarities and merits or demerits, I have nothing to say here. I desire simply to give to the Association some of the conclusions to which my efforts after economy in water gas making have brought me, hoping they will be of use to some member about to enter this comparatively new branch of our business.

The possible economies may be grouped under two heads, entitled respectively, plant construction and operation. Granting that a proper design has been selected there is little to be said about construction. As in coal gas or any other manufacturing plant, so in water gas the apparently cheap is often the really dear, and the saving of dollars in construction may result in the waste of eagles in operation and repairs. The importance of a good construction in water gas plant is even greater than coal gas, because every portion of the apparatus is necessary to the manufacture. A coal gas works can lay off a bench for repairs at almost any time, without danger of landing the holder. With a water gas plant, except in the largest works, where they may be in duplicate, all repairs in the busy season must be made in the shortest possible time—for the night's supply of gas depends upon one generator; hence the importance of first-class construction and readiness of access for repairs can hardly be exaggerated. There is no difficulty about constructing a plant which will need no repairs extensive enough to cause any delay during the winter, but it takes more iron and brick than another may which will make as much gas per day while in operation, but is liable to fail at a critical time. The take-off pipes are subject to occasional stoppage from careless working, and it is important that they should be put up with crosses and hand plates. All parts of the apparatus, in fact, should be made easily and quickly accessible by the use of plates and doors.

In locating a generator the most important point to be considered is the ease with which coal can be handled to it; yet it is one which must yield in part in extensions of old works to the location of the boilers. When an entirely new plant is erected the generator is best located where the handling of coal to it and ash from it will be easiest, and the rest of the plant made to conform. A generator requires either a cellar or a firing floor, and the coal or the ash must be elevated, unless the works are on rising ground, where one may be wheeled in and the other out without elevation. Unless the necessity of using an old building with a low roof, or some other local complication arises, I should not hesitate to adopt the elevated firing floor. The cost of raising the coal is slight, and the advantage of a well ventilated and lighted clinkering floor is great.

Under the head of operating expenses are three important items, viz., fuel, oil and labor; and upon the way the first is manipulated will depend in great part the cost of purification.

As the boilers, engines and pumps of a water gas plant have no features distinguishing them from those in use for other purposes, I will not consider them; therefore the first part of the apparatus to be noticed in connection with fuel economy is the blast pipes. All blast furnace experience shows the importance of having them large with long bends. On this point I have no comparative figures, but it is self-evident that reduced resistance to the blast will result in reduced consumption of fuel under the boilers.

Passing to the generators the question meets us—and upon it there has been, and may still be, a difference of opinion—shall the fuel bed be deep, five feet and upwards, or shallow, three feet and under? One objection to a shallow bed is that there is danger that an opening in the fuel, or a heavy clinker, will so far reduce the available depth of hot carbon that steam will escape undecomposed, or converted only to carbonic acid and hydrogen. Many experiments have convinced me that the possible rate of make of a certain standard purity (freedom from carbonic acid), or the degree of purity with a certain rate of make, is less with a shallow than with a deep fuel bed. Steam in the presence of incandescent carbon is decomposed, the oxygen uniting with the carbon. In the presence of an excess of oxygen carbonic acid is formed, to be converted into carbonic oxide by further contact with hot fuel. The larger part of the carbonic acid is almost immediately converted, but a certain quantity requires further contact, and the last portion, being more diluted, requires more depth of fuel for its conversion than any other equal portion. Experiments have shown me that the best gas is made at the beginning of a run, or when the depth of hot fuel was greatest. From these experiments, all made with apparatus on a working scale, I have come to the conclusion that a deep bed of fuel is desirable. One, and the principal, objection known to me is that in blasting the escaping gases from a deep fuel bed will be almost entirely nitrogen and carbonic oxide, the latter carrying off more carbon than would the carbonic acid made with a less depth of uel. Where there are, as in making carburetted water gas, opportunities of utilizing the carbonic oxide to heat a fixing chamber, superheating steam, or preheating oil or blast, this objection disappears.

It is obvious that the arrangement of grate should be such as to bring the blast and steam into contact with every possible piece of fuel, and that there should be no ledges or offsets upon which coal could lodge away from their direct action Fuel in such positions will gradually burn away in the eddies made by the blast, but will aid little in the manufacture of gas.

In burning the producer gas in the fixing chamber or superheaters, I often find that too much or too little air (generally the former) is admitted. Either will result in loss of heat, and delay in bringing the vessel to a proper temperature. The perfect point is where neither free oxygen nor carbonic oxide is present in the escaping gases; but it takes a chemical test to determine this. The practical way is to admit just air enough to keep the blue flame from showing at the outlet.

The introduction of steam into the generator at as high a temperature as possible is of advantage in two ways; it restores to the generator some of the heat given off in blasting, and prevents in part the quenching of the hot fuel with the consequent shortening of the period of gas making.

An extensive experiment with a cupola blasted with a jet blower, has shown that the amount of ash and cinder taken from it, when using steam at about 300° F., was 50 per cent. in excess of the amount taken from the same cupola, doing the same work, with steam at 650° F., about. As the ash in each instance must have been the same, the excess in one case must have been due to fuel quenched by wet steam.

The benefit derived from using superheated steam was in part neutralized by the fact that the generator required clinkering twice as often, with a consequent loss of time and consumption of fuel for heating. Experience has convinced me, however, that the advantage is decidedly upon the side of hot steam. Mr. Carroll, of New Orleans, La., has made many experiments upon this point, and he agrees with me. Several months' running of two sets of water gas apparatus standing in the same building, and exactly similar, except that one had steam superheaters, showed a saving of two pounds of fuel per 1,000 cubic feet for the superheaters, which, in this case, were not large enough to utilize all the available so-called "waste heat."

One of the difficulties experienced in the use of retort coke in generators has been the rapid quenching of the fuel by the steam. Coke, being light, has less storage capacity for heat than has anthracite, and is more rapidly cooled. In my experience increasing the temperature of steam from 300° to 700° has enabled me to use soft coke with greater success. There is no difficulty in bringing steam to a temperature of over 600° before sending it into the generator, and with the "waste heat." After the first run, in blasting, the fixing chamber is heated before the generator is in condition to make gas, and a part of the "waste heat" can be stored in brickwork, to be absorbed by the steam during the succeeding run.

Gas issues from a fixing chamber at a high temperature, the heat it carries away being absorbed by water in the condensers. In a large plant now building it is sought to utilize this heat for the volatilization of oil before sending it into the apparatus. I believe this will be accomplished and good will result in two ways—heat otherwise wasted will be utilized, and the cooling effect of sending cold oil upon hot fuel will be avoided. The bad effect of this cold oil is greater than would appear at first thought. I have known of its cooling a path for itself through a shallow fuel bed, and actually reaching the ashpit as a liquid. I believe that if no "waste heat" is available for vaporizing the oil, it would pay to do it with steam. Cold oil chills the fuel and shortens the run, to prolong which is worthy the most earnest efforts of the gas maker. It is the period of production, and as it is long or short compared to the alternate period of blasting, so is the producing power of the plant greater or less.

I will speak of one more point in connection with fuel economy, and I know that my opinion upon it is different to that held by some water gas constructors. I refer to the proper direction in which to blast; whether it is the same as followed by the steam in making gas, or, as in my opinion, the reverse? The effect of making water gas is to cool the fuel. Only through the decomposition of steam, which absorbs a large quantity of heat, can water gas be produced, and the first layers of fuel operated upon are rapidly lowered in temperature until they reach that of the incoming steam. Where the blast is directly applied some of this fuel does not reignite thoroughly, for the cold air passes through it before reaching the still heated mass above. This is especially the case with coke, which, from its porosity, becomes more thoroughly cooled by the steam. Where the direction is reversed, and the steam enters at the top of the fuel, its cooling effect is entirely overcome at the next blasting, for the air, before reaching the cooled portion, passes through the heated mass below it. I have knowledge of an experiment which illustrates the good effect of this way of working. A plant in which the direction of steam and blast had been different was changed for a time to work on the other plan The result was an increase of 7 pounds per 1,000 cubic feet of gas in the fuel account. There was no superheater connected with this plant. It should be mentioned that introducing steam at the top of a deep fuel bed has the effect of increasing the clinker, as does the superheating of the steam. This effect can, however, be overcome. I know of a plant which works in this way, and has not in six months had its fires drawn. At the end of every 12 hours wet steam is admitted at the bottom of the fire for one run. The effect is to soften the clinker, which is then easily broken and removed.

Upon the question of oil economy there are few points to be observed; but these few are of great importance to the water gas maker. If the temperature of the mixing chamber is such that the condensation contains only traces of lampblack or light oil, I think the manager need not worry about his oil account. I believe the best temperature to be a cherry red, but this depends upon the quality of the oil, and the area and height of the fixing chamber compared to the rate of make. I try to run as near to the lampblack limit as possible without touching it. While, as coal gas makers, we have given time and labor to solve the problem how best to shorten the stay of gas in the retort, as water gas makers we seem hardly to have thought of the effect of long contact with hot bricks upon our enriching material. Reasoning from analogy, I believe that we should shorten the stay of our product in the fixing chamber to the least possible period consistent with the thorough gasification of the oil. The fact that we may find no deposit of carbon proves nothing; for, upon blasting, the deposit would be carried off unless very heavy.

To economize labor in water gas making it is necessary, as in all manufacturing, that everything the men have to handle should be convenient to them. The boiler can be on the firing floor; a double-cylinder engine on the floor below can always be started from above; and, by arranging these things thus conveniently, in a small works one smart man can make all the gas in hours of daylight. A works sending out 20,000 cu. ft. per day, with a storage capacity of 50,000, can be safely run by two men, who shall make gas but a part of one day in two, and can give the rest of their time to services, meter setting, etc.

I have so far treated of water gas as made by the cupola process only. To go into the question of the relative efficiency and economy of this and other systems of making carburetted water gas would make my contribution to this meeting too long. Before closing, however, I desire to compare the candle power developed per gallon of oil in pure oil gas; in a mixture of oil gas made in retorts with water gas made in cupolas; and in carburetted water gas made at one operation in cupolas.

Mr. J. Desha Patton has said that commercial benzene will yield, in regular working in a retort, 70 cu. ft. of 70-candle gas, or 4,900 candle-feet per gallon. In the Pintsch system the yield is, from crude oil, about 70-cu. ft. of 50-candle gas, or 3,500 candle-feet per gallon. The best result I have been able to obtain in clay retorts is 70 cu. ft. of 60-candle gas, or 4,200 candle-feet per gallon of naphtha. I have the results obtained from mixtures of oil and water gases in different proportions upon a commercial scale, the gases being made separately. At a small works in New England, where gas is made in this way of 35-candle power, the yield per gallon of naphtha, in 1883, was 3,509 candle-feet. At New Orleans, La., in June, 1885, the yield, making a 33½-candle gas, was 4,432 candle-feet per gallon; and though I have made many experiments with different mixtures, this is the best result I ever obtained.

The following results, representing, I think, fairly what can be done with the cupola system, are based upon information obtained by me directly from the books of companies, or the statements of engineers in charge. They vary considerably, and represent five different so called "processes," the names of which, for obvious reasons, I do not give. The highest yield per gallon of which I have a record is 6,302 candle-feet. From that the figures range down thus: 5,647, 5,526, 5,471, 5,467, 5,251, 5,000, to 4,687 candle-feet per gallon. Here we have the material for a comparison of the results obtained from oil in regular working under three systems:

First, with pure oil gas .....4,900, 4,200, 3,500 candle-feet.
Secondly, with gases mixed after generation.....4,432, 3,509 candle-feet.
Thirdly, with carburetted water gas made at one operation in cupolas .....6,302 down to 4,687 candle-feet.

I believe the advantage in the cupola system to consist in the almost complete conversion of the oil into gas. In the retort process as I have worked it the tar made equals nearly 10 per cent. of the oil used. In the cupola system it is only about 2 per cent.

Discussion.

The President—As our membership numbers many water gas people, we ought to hear from them with regard to their experience in relation to some of the facts stated by Mr. Clark. Mr. Clark's paper contains a great deal of valuable information, which must be deliberately studied to be fully appreciated. For my part, I very much favor a deep bed of fuel, with the steam brought in on top.

Mr. Clark—Brought in in reverse from the blast?

The President—That is different from the experience of some companies whose working reports I have seen. Is not Mr. Lansden using a Granger generator, with a thin body of fuel?

Mr. Lansden—We were, but are not now.

The President—We would like to hear from you on that subject.

Mr. Lansden—A year ago we had two large Granger machines in the Washington (D. C.) works. Mr. McIlhenny had one of the machines lengthened out. In our original Granger machines the generators carried about 5½ to 6 feet of fuel, and the machines were fed by severa

small tanks, probably 5 feet in height by 2½ feet in diameter, the oil passing into each generator through four little cocks, fitted with glass gauges showing the oil while running. We took these out and dismantled the tanks, replacing them with a tank located some 300 or 400 feet from the works, elevated sufficiently to give us a supply for the whole machinery from one receptacle. I brought that into the works, attached a box with a float ball in it similar to an ordinary closet. I then attached, for each machine, an inch pipe, bringing it up through the floor to the height of about 3 feet, and put on that a 1-inch stopcock The inch pipe then ran to the machine, and the machine was divided into four sections. The stopcock has a lever handle to it 12 inches long. Under that is the segment of a circle, by which the cock can be turned to the same point every time. That system enabled a machine that had been making 600,000 cu. ft. to produce 750,000 cu. ft. in the same time. We are running right along with it at that rate, and have even done better. I claim that the main thing secured is that we now have a regular feed of oil supplied all the time, insuring perfect uniformity.

Mr. Lowe—I would like to ask Mr. Lansden what, if any, advantage they found in increasing the fire below their generator.

Mr. Lansden—We found, just as Mr. Clark stated in his paper, that when using the blast from the bottom the fire would go out. Although the generators were of the same diameter, we were able to increase the capacity of the machine a little over 50 per cent.

Mr. Lowe—I am decidedly in favor of deep fires in generators. In fact, I think you cannot get them much too deep. I have used 12-feet fires, and found great advantage in them. It does not take any more coal to keep a deep than a shallow bed going; in fact, I think it takes considerably less. I think Mr. Clark's paper is a very able one. I have made many experiments, and my results closely coincide with what he has told us. I am a great advocate of using superheated steam, and believe we can make a third more gas from the same amount of coal with superheated steam than when wet steam is used. I never found much difference in the clinkering of a generator fire, using superheated steam over wet steam; and when clinkers did appear I adopted the remedy of introducing wet steam, which rapidly softens the clinkers and causes them to fall. If more than usually obstinate, I put in oyster shells, fluxing them down as you would in a blast furnace, and found it to be a very satisfactory plan.

The President—The Association would like to hear from Mr. A. C. Humphreys on this subject, as he has had much experience in it.

Mr. A. C. Humphreys—I do not find myself in a position to discuss Mr. Clark's paper, chiefly for the reason that I agree almost entirely with his every statement. There is no doubt that a deep fuel bed is the proper thing. Although in the past we have perhaps been identified with the shallow fuel bed, we have now rather eliminated that from our drawings. We are to-day putting in nothing less than 5-feet beds. With regard to superheated steam, there can be no question about the accuracy of Mr. Clark's position, because we want the heat in the steam for two purposes—as a matter of economy, and also for the better operation of the generator after it is admitted. From our experience, the question of where to admit the oil is not very important, provided we admit it in the right way when we get it there. The whole point is to bring it to the temperature required, and the temperature to which it should be superheated is entirely governed by the quality of the oil. We can handle naphtha without trouble by simply raising the temperature of the steam to the ordinary boiler pressure as we run the works. When using the heavy oil, which we do largely in many works, we have to bring about other methods for superheating it, and there comes in the question of using the waste products from the generator, or from the superheater, or perhaps the waste heat in the illuminating gas as it is made. I think Mr. Clark touched on that method in his paper. In regard to the exact proportion of superheater, and in relation to the regenerator, much yet remains for solution. In the past no doubt a great mistake was made in having the superheater entirely too small for the regenerator. Our practice now is this—say, for instance, that with the regenerator 5 feet in diameter, there is a fuel bed 5 feet in depth, the superheater being of the same diameter, and probably 22 feet high. A few years ago this would have been looked upon as absurd. We do not find, however, and have no reason yet to believe, that that superheater is too large, or that we subject the gas to contact with too great a heated surface, providing our temperatures are right. I am a very firm believer in having surface enough, and so being able to run at low temperatures. That is the only point in which I differ from Mr. Clark. I do not believe in keeping our temperature very high, if we can get our result without. Our experiments go to show that we can, provided we have surface enough. Especially is this the case in the use of heavy oils—I mean oils having a gravity of 27 to 33, which we are using with entire success. We also class, under heavy oils, crude petroleum; and the treatment for those oils is entirely different from the treatment for naphtha. In a number of cases our superintendents have sent back word it was impossible to use the oil—that it could not be done. We have, in such cases, by following it up and insisting upon its use, and sending directions, and perhaps a special engineer to look after the thing, been so far successful, finally, in every case. One or two cases exist in which we are still having trouble, but no doubt it will be remedied. The whole question is one as to temperature and heated surface.

Mr. Lansden—I will say, with reference to the size of the superheater spoken of, that we have one 24 feet high; and I know that it works better than those which are only 18. I would like to ask Mr. Clark what he considers the fair amount of coal to the thousand feet of gas, for all purposes.

Mr. Clark—That is rather a pointed question. The answer depends, of course, on the size of the works. I do not know of anything better than 40 pounds per thousand, all round. If there is anything better than that I am not aware of it.

The President—The Association would like to hear from Mr. Edgerton, of New Orleans, on this question.

Mr. Edgerton—I have nothing to say with regard to this, except to ask Mr. Clark how his comparison of the yield and quality of gas is based. I I do not understand the comparison. I have ordinarily seen it stated that so many gallons of oil will make a thousand feet of a certain standard. I must confess to a little confusion, and I do not understand exactly what results he gets at. I would like to inquire the number of gallons of oil and the pounds of fuel used per thousand cubic feet of gas.

Mr. Clark—My comparison was simply regarding the illuminating power of oil as used in the two different methods. First, the mixture of oil and water gas and then carburetted, and water gas made at one operation, I put into candle feet, as being the simplest way of showing the amount of light that we got from a gallon of oil. In the case of pure oil I multiplied the yield per gallon by the candle power of the oil. In the case of the mixture of oil and water gas I multiplied the candle power by one thousand feet, and divided by the number of gallons used in making the thousand feet, which gave the number of light units as expressed in candle feet which we got from one gallon of oil. I am aware this is not the most scientific way of doing it, yet it is the best way I can think of presenting it to coal gas men who are familiar with Mr. Farmer's candle feet theory.

Mr. Edgerton—What style of burner did you use in testing the water gas?

Mr. Clark—In testing the water gas I employed the simple burner in everyday use, and a Scotch tip burner, consuming from 1 to 2 feet per hour on the pure oil gas.

Mr. Edgerton—I must confess, if I understand it correctly in candle feet, you show that in one process, or by my regenerator and superheater system, there is some 30 per cent. difference than when manufactured separately. Is that correct?

Mr. Clark—I think so. I did not work out the percentage any higher.

Mr. Edgerton—That statement contains something entirely novel. I cannot discuss it in candle feet, because my results are not translated into candle feet. But in the plan of manufacturing water gas at one operation, and then carburetting, and manufacturing again, and passing through the superheater, there is no published result which shows any such discrepancy. I should be very glad to know where such statements can be found, so that I may look into them. I do not doubt the result stated; but still I would like to examine further.

Mr. Clark—The results, with reference to gases made separately and mixed afterwards, were, as stated, obtained in one case from the New Orleans works, the other being the result of a year's work accomplished in a New England gas plant. Regarding the results obtained in making the gas at one process, these were obtained, as stated, with five different processes. I do not give their names, because I do not want to introduce civil war into this Association; but I either have the figures myself from books of the companies, or obtained them from statements of the engineers in charge.

Mr. Edgerton—Do they not largely exceed any public statement?

Mr. Clark—I do not think so. I took them as being a fair average. Some of those figures were obtained from members of this Association.

Mr. Pearson—You have given the number of candle feet to the gallon of oil. Can you give the figures as to the pounds of coal and the amount of water as steam; and can you tell us what percentage of carbonic oxide is present in the highly superheated steam as compared with the wet steam?

Mr. Clark—The proportion of carbonic oxide would be greater, because the gas would be washed with less carbonic acid.

Mr. Pearson—Can you give the relative proportion?

Mr. Clark—In the finished gas I suppose there is 30 per cent.

Mr. E. C. Jones—I was pleased to hear Mr. Clark state his reduction of gas in candle feet. There is a wide diversity of opinion with regard to the amount of oil used per thousand feet, to produce a given candle power of gas. I am very much in favor of hourly or half-hourly observation of the photometer in connection with the amount of gas made. If it can be demonstrated that there is 4,200 candle feet in a gallon of oil of certain quality, I think that the measure of the production of gas in candle feet will tell us what we are doing with our oil—whether we are making gas with it, or making lampblack of it.

On motion of Mr. Boardman, a vote of thanks was tendered Mr. Clark for his paper.

First Day—Afternoon Session.

Mr. A. C. Humphreys, M.E., Phila., Pa., read the following paper, entitled—

"ILLUMINATION VS. CANDLE POWER."

I have undertaken to prepare for this meeting a paper under the title of "Illumination vs. Candle Power." The subject of measurement of light is a large one, and I cannot hope to more than touch upon certain special features of the subject. The title will suggest that I have in mind some of the papers recently written in this line, namely: The paper by Mr. Boardman,* at our last year's meeting; the papers by Messrs. Prichard† and Taber,‡ at the last meeting of the New England Association; and the paper by Mr. Chollar,§ at the last meeting of the Western Association.

Mr. Boardman told us, you will remember, of the increase from 16 to 22-candle power he obtained by substituting a student's Argand chimney for a regular Argand chimney, but that while he obtained this apparent advantage the "illumination" was actually less, as shown by applying the chimney to an Argand at his house. In the paper and the following discussion you were told that a white light would not "diffuse" as well as a yellow light. It was also stated during the discussion, and with great confidence, that a 16 candle coal gas gave as much light, on account of this "extra diffusibility," as a 20-candle water gas—the 20-candle water gas being whiter than the coal gas; and in explanation of this it was suggested that the whiter light from water gas "was intense, local, but not diffusive like coal gas."

In Mr. Prichard's paper considerable stress is laid upon a law of the intensity of light to the effect that "rays *emitted* obliquely from a surface are less intense in proportion as they are more inclined to the surface which emits them," and then, that by this law "the rays of light from a flame as they leave the horizontal and approach the vertical, leave the maximum measured candle power and approach the minimum of zero." We were also told that flames must be of the same size and same color to enable us to measure their lighting power correctly. The old question of the opal globe was also brought up prominently. It was also proposed that *daylight should be* regarded as the standard—that is, a white light. Also, that a 16-candle gas, which was whiter than the richer 20-candle, on account of its increased "temperature per unit of flame areas," produced a better light than the richer gas—of Boston. A disagreement from what has gone before is here to be noted.

By Mr. Taber's paper we were reminded of the uncertainty of our photometrical measurements. The varying quality of the so-called standard candle, the necessity for bars of varying length according to the strength of the light, the lack of accurate formula for correction of candle and gas consumption, the question as to how to read the disc, the color trouble, the abnormal condition of atmosphere—fog, for instance—entering as a disturbing element. And also, the opinion is expressed that the subject is one for the physicist instead of the gas engineer. Then, by a carefully prepared table, it is to be noticed that the candle power does not follow the amount of bromine illuminants, and that CO is a positive evil. In the discussion which followed the example of the illumination from a bull's-eye lantern is used to demonstrate the varying power of the rays emitted by a gas flame according to the angle they make with the surface of the flame. Also, we were told that candle power "means nothing." Mr. Taber found that Mr. Boardman's experiment gave him an increase in candle power of from 16 to 19.44. Mr. Prichard had found no difference whatever.

Mr. Thomas spoke of the relative values of oil lights and gas lights—compared directly, I presume—and that the "illuminating duty" of one 18-candle gas flame was found to be far in excess of two 12-candle oil lamps. This was the result of a careful test—presumably with a bar photometer. The experience of Dr. Morton in measuring so-called 2,000-candle electric lights is referred to, and we are reminded that he only found them to be from 500 to 1,100 candles; and the opinion is expressed that if a photometer had been used in these experiments the light would have largely exceeded 1,100 candles. Also, that an observer looking at a 36-candle and a 19-candle gas, as ordinarily burned, would have difficulty in distinguishing between them; and, still further, the belief was expressed that a 19-candle gas would afford a better illumination than a 36-candle gas. Parenthetically, I would here like to say that if the gentlemen would guarantee to convince our consumers on this point, I should be only too glad to accept the theory, anyway during business hours, and let the statement go unchallenged.

At the close of this discussion Messrs. Prichard and Taber were appointed as a committee to continue their investigations and experiments during the following year.

In Mr. Chollar's paper we are told to beware how we put our faith in the law which says that the light from a luminous body decreases in proportion to the square of the distance—that is, the law upon which photometry is based; and he also refers to Prof. Tait's statement of the law, namely, "If the medium be transparent, the intensity of illumination which a luminous *point* can produce on a *white* surface *directly* exposed to it is inversely as the square of the distance."

Attention is then drawn to the fact that the well-known law is simply following out the principle that the surfaces of spheres are to each other as the squares of their diameters. Then the proof is attempted of the proposition that, "irrespective of intensity, the quantity of light from a luminous body at any particular point is independent of the distance of the body, and is in direct proportion to its diameter;" and it is stated, "The rule governing the value of lights, therefore, would be something like this: The light from a luminous body is inversely as the square of its distance, and directly as its projected area." We are also advised in the study of the subject to drop empiricism and go at the matter as thoroughly and systematically as the electricians do in their measurements; and we are encouraged to believe that we shall be able, by means of high candle power lamps, to compete with the 1,200 and 2,000 candle power electric lights.

These papers you have doubtless all read, and it may seem that it was unnecessary for me at this time to refer to them at such length. My object has been to bring clearly before you the fact that there is in the minds of the gas engineers of America much uncertainty on the subject of light and its measurement, and to demonstrate the necessity of a special consideration of this subject on the part of this Association. I take it for granted that we are all gas engineers—not coal gas engineers, or water gas engineers, or oil gas engineers, or wood gas engineers, or any other special kind of gas engineers. Perhaps it would be better if we said we were light engineers. If we cannot go this far, it is high time we went far enough to be able to say that in this Association we are gas engineers, and that we are ready to study any subject in connection with our business so as, as far as possible, to get at the exact truth, let it strike where it will. I believe most of the members will acknowledge there is room for improvement in this direction, though I am, for one, glad to acknowledge there is every appearance of a movement toward the overthrow of prejudice. I cannot expect to try to meet all the points raised in the papers referred to, and I know you would be sorry to have me attempt it. I believe, however, that I have been able to make certain experiments which will tend to clear up some of the questions raised.

It certainly is very deplorable if we must acknowledge to the public that we can tell actually nothing as to the value of the light we offer to them; and that is what we must practically acknowledge if we leave the subject at this point. Of course, the foundation laws of intensity of light which have governed us in our photometric work are:

I. The intensity of illumination on a given surface is inversely as the square of the distance from the source of light.

II. The intensity of illumination which is received obliquely is proportional to the cosine of the angle which the luminous rays make with the normal to the illuminated surface.

It is with the first law we are chiefly concerned, for we can provide against the second law interfering in our photometric work by having the disc at right angles to the rays from the light to be measured; and this can be practically done, even if two candles are used, by the use of a bar of sufficient length.

I think that Mr. Prichard, where in his paper he refers to the rays *emitted* obliquely, has this law in mind, and most of his troubles appear to come from a misconception of this law. The law has nothing to do with the emission of light from an oblique luminous surface, but refers to the illumination of a surface oblique to the rays, and simply shows that mathematically, by reason of the incline of the surface, a greater area is exposed to the rays. Therefore we spread a certain number of rays over a greater area than in the case of a perpendicular surface, and consequently the intensity of illumination is diminished. And the exact measure of this inclined surface, as compared with the perpendicular

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*Vol. XLVI., Jan. 3, '87, p. 7. †‡Same vol., Mar. 2, pp. 130, 140. §Vol. XLVII., July 2, '87, p. 7.

DIAGRAM OF THE VARIATION OF THE CANDLE-POWER OF A BAT-WING FLAME, BY OBSERVATIONS FROM THE FLAT TO THE EDGE OF THE FLAME.

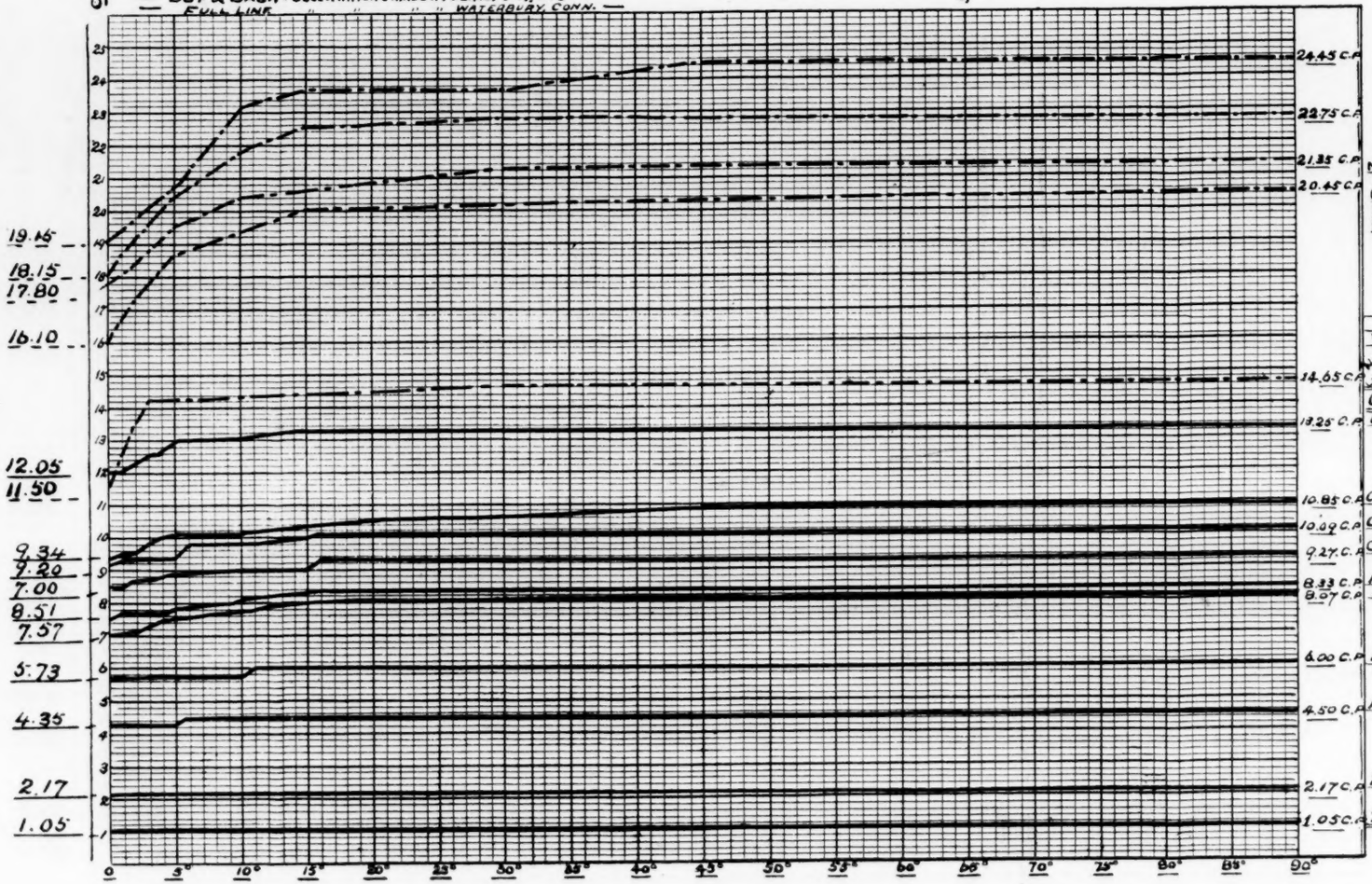
MEAN ANGLE OF MEAN LIGHT.

— 4.68 —

MEAN OF 15 OBSERVATIONS

CANDLES ● ● PHOTOMETER BAR. 90° or FLAT — "BAT-WING FLAME" 0° or EDGE

— DOT & DASH - OBSERVATIONS MADE AT JERSEY CITY, N.J —
— FULL LINE " " " " WATERBURY, CONN. —



— TABLE —

CANDLE POWER FLAT 90°	CANDLE POWER EDGE 0°	DIFF FLAT to Edge	MEAN CANDLE POWER	MEAN ANGLE	CANDLE POWER % of Loss
24.45	19.15	5.30	21.80	7.25°	21.67
22.75	18.15	4.60	20.45	5.25°	20.22
21.25	17.80	3.35	19.57	5.00°	16.62
20.45	16.10	4.35	18.28	4.25°	21.27
14.65	11.50	3.15	13.07	1.50°	21.50
13.25	12.05	1.20	12.60	4.00°	9.05
10.85	9.34	1.51	10.09	5.00°	13.91
10.09	9.20	0.89	9.64	5.75°	8.82
8.07	7.00	1.07	7.53	4.00°	13.26
9.27	8.51	0.76	8.89	6.25°	8.19
8.33	7.57	0.76	7.95	6.00°	9.12
6.00	5.73	0.27	5.87	10.25°	4.50
4.50	4.35	0.15	4.43	3.75°	3.33
2.17	2.17	0.00	2.17	—	—
1.05	1.05	—	1.05	—	—

NOTE:
MIXTURES OF JERSEY CITY GAS NOT CALCULATED — GAS MIXED IN PIPES — SAME BURNER IN EVERY CASE.

MIXTURES OF WATER GAS		
Non Luminous	Illuminating	
Cu. Ft.	Cu. Ft.	C.P.
0.1	4.9	20.38
0.25	4.75	21.82
0.50	4.50	20.82
0.75	4.25	21.7
1.0	4.0	22.3
—	—	—
1.25	3.75	19.56
1.50	3.50	—
2.	3.	23.0
2.5	2.5	20.25

surface, if found to be proportional to the cosine of the angle made by the ray with the normal to the illumined surface. This, therefore, need not come in to bother us. We only have to take account of it so far as to see to it that our photometer is adjusted to reduce the error from this source practically to zero. Part of the confusion on this point may have come from the fact that a flame is not entirely transparent to its own light, as shown by the difference in readings shown between the flame on edge and the flame on the flat. On this point there has been great diversity of opinion, and the rule, I believe, somewhat generally followed has been to take the reading from the flame at 45° as giving the average.

In my past experiments I very quickly satisfied myself of the incorrectness of this as a general rule, and, therefore, in connection with this work I assigned to one of my assistants a somewhat elaborate set of experiments to determine what angle gave the mean reading, and this with different qualities of gas. The following table, prepared by the assistant referred to (Mr. C. Russell Collins, M.E.), shows the *average* of the *mean* readings, or the mean angle of mean light to be 4.68°, and that this mean angle varies with the candle power of the gas. The differences of candle power were obtained by mixing different percentages of fuel (non-illuminating) water gas and illuminating water gas.

[For tables and accompanying diagram, see Supplement.]

By this table we find the angle of mean illumination, or mean candle power for the whole series of experiments, is 4.68°. In the case of the mixture which gave 24.45-candle power on the flat, the mean angle was 7.25°. The largest mean angle was in the case of the 6-candle power on the flat, in which case it was 10.25°. In two cases of very low candle power no difference from edge to flat was observable. This question of the mean angle is an important one, and the table given goes to show that, taking the average, our flat flame burner is doing its best for about 280° out of the 360°. It is also worthy of note that at 45° we have practically reached the maximum in every case. The percentage of difference in candle power between the edge and flat runs from zero to 21.67. This difference increases apparently with the candle power of the gas. Intensity of combustion no doubt enters in also to affect the transparency of the flame. The different mixtures were burned with the same burner. Had a burner been carefully selected for each mixture, a different candle power would have been obtained, and no doubt a different result as to variation of candle power from edge to flat.

The importance of adjusting a burner for a particular gas, especially in comparative tests, is, I believe, often lost sight of. For instance, we have the table showing loss of light by mixing air with 12-candle power gas, 1 per cent. of air destroying 6 per cent. of light, and so on up to 40 per cent., where the light is entirely destroyed.

Some years ago I had occasion to test this matter with Pintsch gas. A full set of experiments was made, and of course I at once saw that while there was a very serious loss if the same burner was used, there was no such loss with this rich gas as in the case of the 12-candle power gas. By very carefully selecting a burner for each mixture I finally succeeded in mixing in 40 per cent. of air in a 50-candle gas, and was still able to get as high a result per foot of gas used, as I obtained by the unmixed gas burned in the small burner selected therefor.

I bring this point out also to emphasize the fact that in making our experiments and drawing our conclusions therefrom, we must bear in mind that to compare two gases we must have a burner properly adjusted for each. For instance, Mr. Boardman with his student argand chimney varied his candle power from 16 to 22; Mr. Taber raised his from 16 to 19.4; Mr. Prichard was unable to observe any difference. In my first experiments with gas varying from 24.78 to 12.70, and under different consumptions, I obtained varying results, sometimes there being a gain for student argand chimney, and sometimes a loss. In my last series of experiments, the candle power of the coal gas fell from 16.47 to 14.37. I do not doubt I could have obtained different results in both cases by different adjustments as to height of flame alone.

This suggests, did Mr. Boardman get the same adjustment at his house that he got in his photometer room; and did he allow in his practical test at his house (where he was vainly trying to read, and his wife to thread her needle) for the fact that, when his argand with the ordinary chimney had been consuming probably 7 feet, with the student argand chimney he was only consuming about 3.8 feet?

Say 7 feet 16-candle power gas=22.4-candle power.
Say 3.8 feet 22-candle power gas=16.72-candle power.

The fact of smaller consumption being necessary to avoid smoke in the case of student argand chimney, and also the fact that these experiments were made 10 years previous to the reading of his paper, Mr. Boardman informed me of by letter.

Coming back to the first law—this is a law entirely dependent upon mathematical principles, and I was surprised to find an intimation in Mr. Chollar's paper that the law was supposed by some to be based upon something outside of mathematics. The law is easily illustrated by supposing a light coming from a point situated at the geometrical center of a hollow sphere—the total illumination from this point will be spread over the inside of this sphere and every part of the surface will be equally illuminated. Suppose now that the sphere is increased in size until its radius is just twice the radius in the first case; as the areas of surfaces of spheres vary as the squares of their diameters or radii, the sphere in the second case will have an area just four times as great as in the first case, and as the amount of light has not been changed, the same amount will have to be spread over four times as great an area—that is, the intensity of illumination is one-fourth as great, or inversely as the square of the distance from the source of illumination.

The law as stated by Prof. Tait, and which Mr. Chollar thinks so much preferable, is the law as it is generally understood; but it is stated more fully than is usual, and includes a reference to the second law. We all know that the calculations are based upon the supposition of the light coming from a point. We also understand that the medium through which the light is to be transmitted must be transparent; we do not expect a law that will apply alike to all conditions in this direction—for instance, the interposition of a red or blue globe, a globe full of steam to represent fog, etc. We also expect results to vary as to illumination of objects different in color. We do not expect to get the same effect if our walls are black as if they were white; and, as before stated, we do not expect to measure lights against each other, unless we provide for the rays in both cases being practically normal to the disk or illuminated object. Mr. Chollar then attempts to prove a new law, in place of our old friend which has stood by us so many years, to the effect that irrespective of intensity the quantity of light is independent of the distance. The second diagram of the article is intended to prove this; but if any of you will study this diagram and bear in mind that every point of the line emits rays in every direction, you will find that the diagram affords no such proof. As in all other laboratory work, we must in the application of the laws involved take account of the sources of error that naturally come in, and see to it that the instrument is used as designed to reduce the error from these sources to a minimum. For instance, length of bar—if the light at one end of the bar is very intense we must expect to lengthen our bar, for obvious reasons. A man's eye should suggest the necessity at once, for if he uses a short bar for a light of even 200-candle power he must expect to so partially paralyze his eye as to render his results valueless. This lengthening of the bar also takes care of the trouble from varying angle of incidence. Difference of color does not interfere much except in the case of a very bright light at one end; then, by lengthening your bar this is so reduced that by considering only the edges of the disk—that is, trying to keep in mind the definition of the disk—a man in moderate practice should arrive at a practically accurate result. The use of a standard burner, such as the Methven or Edgerton, is of great assistance, reducing the trouble from both foregoing sources of error and also overcoming the candle trouble.

As to varying quality of candle—get good candles, and if you find, after careful handling, they are running much out of the way, reject them. As to corrections of gas, set your meter to consume five feet, or almost exactly five feet, if it is a gas proper for such an adjustment. Any correction then necessary to introduce can be safely made by the usual rule. If the gas is, say, a forty-five-candle oil gas, use the burner that will burn it properly, and then figure it to the five-foot basis if you wish to do so for comparison. As that is the proper adjustment for that gas, that is the way to consider its value as a light-giver—namely, direct proportion.

Let us now consider for a moment some of the points which have puzzled us all, and which I believe have led to this discussion. We say an arc light is not so diffusive as a large gas flame, and that we do not get the same duty from it, comparatively. Why should we expect to? Here is an arc light sending out the light of 500 to 1,200 candles, and all practically from a point—the light-giving sur-

The law of Fechner explains the disappointment of the shopkeeper, and aside from the diminished excitability, or hardening of the retina, produced by long exposure to intense light and repeated fatigue, presents the following facts for our consideration.

A 16-candle gas produces an impression equal to the log. 1.204120, while a 20-candle gas produces an impression equal to the log. 1.301030. Thus the candle power is increased 25 per cent., but the impression of brightness on the retina is increased only 8.4 per cent.

The doubling of candle power from 20 to 40 candles causes simply an increase of 23 per cent. of stimulation of the retina, while a 100-candle light will produce only twice the effect on the retina of that exerted by a 10-candle light, notwithstanding the intensity of light is increased ten-fold. This ratio holds good until the retina is exposed to light so intense that we cannot distinguish any increase in brightness.

The gas engineer and the interior decorator should combine their efforts to please the public eye—the one, to supply a mellow and thoroughly diffused light, with no dark shadows lurking about to strain the eyes; the other, to provide pleasing effects on our vision by proper reflection of light and by ingenious devices to prevent the eyes from meeting the glare of the source of light, without materially diminishing the illuminating effect.

Discussion.

The President—We have in these two papers food for a good deal of discussion. Some of the other gentlemen who have previously considered and made experiments in this matter ought now to be heard from. We would like to hear from Mr. Boardman about his experiments.

Mr. Boardman—When I presented that experiment it was with a view to place this matter before you, so that if you wanted you could think over it and work it out. If I had done no more than to call forth the experiments presented here by Mr. Humphreys, I would have been more than repaid for the trouble taken in bringing the subject to your attention. My statement was simply a *recollection* of the experiment. When Mr. Humphreys wrote to me, asking for further explanations, I had to tell him that it was an experiment made some ten years previous. I also told him that, in the experiments with regard to the candle power determined by the student chimney, of course the actual candle power shown by the photometer was not that of 23 but of 22 candles, the result secured after making the necessary corrections for the decreased amount of gas burned by the argand chimney. The same amount of gas cannot be burned in the argand burner with the student chimney as with the straight chimney. But, even with the lesser amount of gas, I got a much higher intensity in the light, and it struck my eye so pleasantly that I thought I must have gained very largely in the illuminating power of the gas. The paper called to mind that I did not make that statement clear in my paper. I think I was on the right track when I cautioned the Association against searching for an intense white light of small size, and giving up the broad flame, with its warm, yellow light. Doubtless, Mr. Humphreys' experiments have impressed that fact more fully upon you than did my statement. I think you will all agree that the water gas flame, as generally burned, is of smaller area than the coal gas flame as usually burned. I would like to have Mr. Humphreys carry his experiments further, and compare the area of the flame of the water gas in the star burner with the area of the coal gas flame of the argand burner, exposed to the disk, showing the approximate sizes of the flame, so as to determine if there would be any difference. I would suggest, if this matter is carried further, that experiments of that character be made. I trust the subject will be pursued to as great length as possible.

The President—We have with us to-day one of our Honorary Members, and one whom we do not see very often—a gentleman who has given the subject a great deal of attention, not only with regard to the gas flame, but also with regard to the electric light. I know I express the wish of every member when I say that we shall all be glad to hear from President Morton on this subject. (Applause.)

President Morton—There are one or two points that have occurred to me in connection with the papers just read which it may be of interest to draw the attention of my fellow members to. These are, in the first place, the very common misconception as to what we mean when we speak of a light ray. People very often speak of a light ray as if the source of light were giving out certain lines of something. Now, the real meaning of a light ray is the direction in which the action of the light is propagated. There is nothing there. In other words, the light ray is not a thing. It is not true that something in the form of a right line, or a straight line, is passing out from the source of light, any more than it would be true to say that the path of the cannon-ball is a line consisting of anything, or being constituted of anything. It is the direction in which the cannon-ball goes.

What, then, is light, so far as we know it? It is a vibratory motion in the elastic medium pervading all space and most bodies. Now, when we have a source of light (suppose for the moment that it is a point), and we say that it emits rays of light, what we really mean is, and what is the fact, is that that point is in effect expanding and contracting, or moving in such a way as to produce successive waves or shells of motion—little spheres, as it were, or a series of spheres. Imagine for a moment that the luminous point suddenly grew large and then small again, whereby it produced a wave or shell of motion. Now, that minute shell of motion produced around this point acts upon the medium outside of it, producing a larger shell of motion; and that again upon the medium outside of it, and so on, just as you might imagine a soap-bubble blown from a point expanding and growing larger and larger as it spreads out. So this first momentary action of the light produces a shell, as it were, of motion, which spreads out equally in all directions. If the source is a point it spreads in every direction, getting attenuated as it spreads. This illustration is, of course, not intended to be exact as expressing in detail the motions of light waves, but as a rough physical illustration it strikes me that it is not, perhaps, a bad one—if you will bear in mind that it is not to be carried too far, and that I do not want to say that a light wave is a substance at all. Imagine a bubble produced from the end of a little pipe and expanding until it fills the whole room. Now, that bubble, at the first instant, contains only a certain amount of substance, and that amount has got to be spread thinner and thinner as it grows larger and larger; so, that if it is twice as large in diameter, a given area of it will only have a quarter as much substance in it. Now, in the case of light, the motion is not in the line in which the force proceeds, but at right angles with it. In other words, if a light ray were passing from this light overhead down on the stage, the motion of the light (the vibrations) would not be in that line, but would be at right angles to it. The particles would be moving at right angles to the direction in which the ray traveled. But that is immaterial in any general consideration. It only becomes important in connection with some recondite subjects, as, for example, that of polarization of light; but in the present case it is immaterial, since we are only considering the subject with reference to the diffusion of light.

Now let us see if we can get a clear idea of what is taking place where light is being emitted by a luminous body. Suppose, for example, that the luminous source is a point emitting these successive shells of motion one after the other, just as if it were a little bubble which was able to expand and spread through the whole building, and then another bubble came right after it, and so on, following each other so quickly that they followed each other at a distance of a quarter of an inch, one bubble within another, and each one expanding continuously through space. That being the condition of things, it follows, as a physical necessity (as a thing the contrary of which is not supposable), that the intensity of that action should diminish with the square of the distance; or, for example, that if the distance is double the intensity or the amount of action on a given area should be one-fourth at the double distance, or at treble distance one-ninth, and so on. This is as necessary as the conclusion that the half of a thing is equal to the other half, or that if a thing is divided into fifty equal parts, each one of those parts will be one-fiftieth of the whole thing. There is no getting away from that reasoning, and if we find that the result of an experiment seems to differ from this, we must be quite sure that there is some error in the experiment. Some time ago there was a very curious trick with a chess-board, which consisted in cutting the chess-board in a certain way and then so putting it together again that out of the 64 squares which exist in a chess-board you could get 66 or 62, according to the way in which the pieces were arranged. Any one looking at that, although they could not explain how the trick was done, yet could be perfectly certain that the two squares were not created or destroyed. So, in this case, if it seems to us that the law of inverse squares in the case of light is not fulfilled, we may be sure we have misunderstood the experiment, or that there is something which we have not taken into account.

Now, suppose that instead of being a point, the source of light were a surface. Then, in the first place, it is manifest that the surface may be divided into an infinitude of points, and that what is true of each one of the points must be substantially true of the entire thing. We cannot have a thing true of each one of a number of individuals, and not true of them altogether. Therefore, if this law is true as to points, it is true of the surface; but in the case of a surface this difference would come in. While each point is giving out rays in this way, in various directions, if we are supposed to look obliquely at this surface, then it is possible that its area is foreshortened, and in effect made smaller than if we were looking at it at right angles. On that account this area will seem to produce less light under certain conditions. If it is a broad, transparent surface which is giving light, and if there is no obstruction of the light by the luminous particles themselves, then there will be no difference whether we look at the surface point-blank or otherwise, for we will still get the same amount of light from it. That is illustrated in certain flames of thin, transparent character which will give us the same amount of light, whether looked at sidewise or frontwise. A number of the experiments just described by Mr. Humphreys illustrate this very admirably. But, if we are dealing with an opaque surface, so that one point can obstruct the light coming from another point, then the light will appear less when looked at obliquely. But that will be only under those peculiar conditions, and it will not be in violation of the general laws of light, but will only be a result of special condition of the particular source of light under discussion, which introduces a new factor or element—that of the obscuration of the light from one point by the presence of some other point of the luminous substance. Let us now consider light emanating from a central source in another way—namely, as a

series of waves moving at right angles to their direction of progress. Such waves would be represented by a wave-shaped line, or, more properly speaking, by a sinusoid curve. They have two prominent characteristics—wave length and wave amplitude or intensity. Wave length depends upon the number produced in a given period of time. That is to say, if they are producing red light, it is because there are about four hundred million million of up and down movements to the second. Four hundred million of million would make the light red. If the motions of all of them were about eight hundred million of million to the second, they would then be producing violet; and between these limits there would be all the various colors, according to the numbers of vibrations. Now, whether there are four hundred million million or eight hundred million million of vibrations produced in each second, they will travel at the same rate. The first one produced will be carried in a second to the distance of about two hundred thousand miles. Whether this motion is made at the rate of four hundred million million in a second or eight hundred million million, it will equally soon get to this distance. At the end of a second, therefore, the wave produced at the beginning of the second will be 200,000 miles off, and between that distant point and the source of light there will be about 400,000,000,000,000 of other waves which had been produced and started out after the first, one after the other, during the second if the source of light was red; or in other words, if the light emitted was red light. If there were four hundred millions of millions of waves in a length of 200,000 miles this would make each wave about one-forty-thousandth of an inch long. If the color of the light was violet there would be about twice as many vibrations produced in the second, and thus twice as many waves in the length of 200,000 miles, and so each wave would be about half as long. The distance longitudinally between one wave and the next is the wave length of light. That is what makes the difference in color. If there are so many to the inch, or each is such a fraction of an inch, it is one color; if it is a different number, then it is another color.

Now comes the question of intensity. If we say that a light is a very bright one we do not mean that it throws out more waves to the inch, or that the motions are given with more or less rapidity; but we mean that each one swings further up and down; and the intensity of the light would be represented by the extent of this motion up and down. In other words, by the height of the waves. We may say that a dim light would be represented by a motion going up and down, say the one-hundred-thousandth of an inch. A picture of this would be a line almost straight, but waving up and down a very little way every forty-thousandth of an inch. If it was a bright light of the same color it would be represented by a curve, with just as many bends in it to the inch, but they would go up and down much more than the other. It would be a steep wave, as distinguished from the other. This also leads us to the same conclusion, that as this motion spreads outward from the center it must decrease in intensity. That is to say, the height and fall of these waves will diminish. A certain amount of something is put in motion in the first instance, and as that motion is spread and goes outward it acts upon a larger and larger area of the substance, and must, therefore, produce less and less effect. Thus the little ring or sphere whose atoms are moving up and down through a large distance will become a great sphere, whose particles are moving up and down through very small distance.

What I wish especially to bring to your attention is this idea that if we want to represent a light wave philosophically, as coming from a source, we will represent it as a curve which begins steeply up and down, but with a given length between the convolutions, and goes on with this constant longitudinal length, but decreases in amplitude, or the height and depth to which it goes, and so decreases very rapidly—in fact so that this amplitude or height of the wave varies inversely as the square of the distance from its source. The length of the wave, however, or the distance between one bend and another in this sinuous line, will be constant for each color. White light being a mixture of all colors, we have in it the result of the combined action of a great many wave lengths; and, therefore, it becomes a very complex thing to think of or discuss. We need not, however, go into this at present, but may rest in the broad conclusion that what is true of each wave length or color is true of the compound of all colors, namely, white light.

There is one point in the last paper read to which I think it would be interesting to draw your attention, and which was no doubt thought of by the reader of the paper, but not mentioned by him; and that is this: Why is it that with greatly increased intensity of light the visual impression is so little increased? In the first place, the law of Fechner referred to could not have been in reference to the illumination of a surface, because Fechner and others, among them Dr. G. W. Draper, of New York, had proved that the eye can detect a difference of illumination equal to the one-sixty-fourth of the greater light, but must have been in relation to the effect of intense light upon the eye—of a brilliant point or area of light examined directly. In fact, he could not assert that by having two candles instead of one you only light up the table, or the book you are looking at with a slight increase (say 25 per cent. more) of illumination; but that if you doubled the actual luminous intensity of a candle flame and looked at it, you would not be aware that it was doubled, but its effect upon the eye would only be an increase of 20 or 25 per cent., as the case might be. What is the reason of that? I believe it to be as follows: The reader of the paper spoke of the pupil of the eye as a diaphragm through which the light passes into the eye. Let me now add that this pupil of the eye is an *adjustable* diaphragm. When you expose the eye to a strong light the aperture in the pupil shrinks up. You can see this action with the aid of a mirror even in your own eyes. You can see it better by looking at the eyes of another person. If you bring a bright candle near the eye the opening of the pupil grows smaller. This is very marked in the eye of a cat, where the closing is only from two sides. In the human eye it closes all around. It merely makes a smaller circular aperture. The pupil in the cat's eye spreads out in the dark, making a round aperture, and then closes up to a narrow slit as it contracts in the light. The result is that, while you are looking at a dim light, this aperture is wide open, letting a great amount of light get in through the open pupil and fall upon the retina. As the light becomes brighter and brighter the aperture shrinks up, and correspondingly closes out the light. The resultant effect is merely the difference between the two. If the closing up was as rapid as the increase there would be no difference perceptible between a dim and a bright light. In judging of amounts of illumination in apartments we must not forget this physiological action just noticed, by reason of which the eye if exposed to a very brilliant light will become less able to perceive a feebler illumination, and, as a consequence, the brighter light will appear to illuminate things more dimly, because the eye has changed its capacity of perceiving. But, this should not discredit the quality of the light, but only indicate that we have not been judicious in our location of it.

The President—I would like to ask President Morton whether he would give us to understand that all lights which on the photometer would measure equally would really be equal illuminants in a room? In other words, whether you would get as much light from a 16-candle Edison light as from a 16-candle bat-wing burner. Theoretically, I suppose you would.

President Morton—Theoretically, and as matter of fact "objectively," using that word in its technical sense. That is, there would be as much light in the room; but to a person coming into the room it would not appear so well illuminated, and for this reason: If the room were illuminated with ten Edison 16-candle lamps, then there would be scattered around in that room a number of very minute spots of light, of intense whiteness. Wherever the images of those struck the retina of the eye they would have a relatively paralyzing effect upon it, and would also cause the pupil to contract. If that same room were illuminated with ten gas flames of large size, then, as one came into that room, he would not find such intense local spots of light; for although there would be the same amount of light from each lamp it would come from a larger area, and would be correspondingly less intense, and the nerve located in those parts of the eye on which the images of these flames fell, instead of being violently shaken by the intense vibration, as they would be in the case of the Edison light, would be more gently vibrated, and this paralyzing or diminishing effect, this dulling of the nerves, would not take place to the same degree, nor would the contraction of the pupil be so great. It is just as it is in coming into a room with the naked gas flames all about you, as compared with the light from the same flames in globes. We all have noticed the pleasant effect of the light upon the room when globes are used. The illumination seems much better with globes than with the more intense light from naked burners. I remember a case where the principle here considered was made strikingly manifest.

In Philadelphia, many years ago, in the Academy of Music, it was found that the stage, which was an extremely wide one, was not sufficiently lighted in the middle by the border lights. Some one suggested that the trouble would be very easily corrected by getting two movable chandeliers, and setting them up on either side of the stage, with a number of gas lights on them. This was done, but only with the result of making the stage appear much darker than before, the reason being that as people looked at the stage their eyes were dazzled by the brilliant light coming from those two great chandeliers; the pupils of their eyes contracted, so that a person standing on the middle of the stage was not so easily seen as before the great lights were put on.

Mr. Gilbert—I would like to ask President Morton a question with regard to the probable practical effect upon the eye of continuous changes in the strength of illumination to which people are exposed nowadays by the necessity of living in extremely brilliant lights; and whether turning the back and then the face to brilliant lights of any kind, and so producing rapid, constant, and unnatural changes in the pupil of the eye, does not tend ultimately, practically, to destroy it?

President Morton—There is no question but that such changes are very trying to the eyes. No one can realize that better than while passing through the tunnel of the New York Central Railroad. If one sits with his eyes open while going rapidly through the tunnel, the effect, as they pass the light shafts, of the rapid changes from light to darkness, is, with most persons, extremely painful. That of course is an exaggerated case; but any sudden and rapid change must be very injurious to the eyes. Burners that flicker, from which the flame jumps up and down, are undoubtedly very severe and dangerous things to the eye. There is no doubt that the present generation are risking their eyesight by the use of so many brilliant lights.

Mr. Graeff—Does President Morton mean when stating that the candle power of the Edison light is equal to the candle power of the gas lamp, if there were a dozen Edison lights at our back they would illuminate the space in front of us as well as would a dozen gas burners? In other words, what I wish to ask is whether candle power is exactly the same, without consideration of its effect upon the retina of the eye.

President Morton—If this candle power, properly measured, is the same, then undoubtedly the illumination of a surface would be identical. In other words, it would be almost stating the same thing in two ways. When we say that the candle power is the same we mean that, on testing with the photometer, and allowing the light to fall on a white surface, we get equal illumination of that surface. If it is true in the photometer it cannot be otherwise than true out of the photometer. It is not the photometer that makes the light.

Mr. Boardman—I would like to speak on that point one moment, because of the evident misapprehension which seems to be in the minds of some with regard to the transmission of illumination, as indicated by the photometer. While practically, as President Morton says, the illuminating effect on the space must be the same, still I must contend that the illumination of space, as we usually inhabit it, is somewhat different. I must contend that as we inhabit space we are certainly all objects of three dimensions; and that any light proceeding from a fixed point does not illuminate so much of the surface—of a column, for instance—as it does if that light proceeds from a plain surface of two dimensions. And, therefore, that the space which is partly illuminated by reflection from that column is not so well illumined as it would be from a surface throwing light upon it, and lighting a larger surface than that, and then reflecting from that to other surfaces. That is the point that I wish to bring out in respect to the use of large surfaces for illuminating the space which we usually inhabit. That is what we have to contend with. We are to light the rooms that we occupy, and the halls in which we meet. We want those lights so distributed that there shall be as little shadow as possible, and that each object in the room shall be as nearly as possible illumined all around, so that the reflection from them may help to illumine other objects which do not get the direct rays. For this reason I respectfully contend that the illumination of the space we inhabit is greater with the flat-flame burner than with the Edison light.

Mr. Clark—I think the proceedings of this year will be very rich in information concerning light—both theoretical and practical. I think we should be specially grateful to Mr. Humphreys for having settled this question of diffusion, as it is one which has vexed us a good deal. The papers are of such a character that it is hard to discuss them off-hand. We will enjoy them very much when reading them, but we cannot readily discuss them on short notice. They are too deep for us.

Mr. Lowe—I would like to ask President Morton a question. If you were to take two flames of equal intensity—for instance, a yellow flame of 20-candle power and a white flame of 20-candle power, and take a given area of each, say one square inch—what would be the difference, if any, in the illumination at equal distances?

President Morton—If they were equal at one distance they would be equal at all other distances. That is to say, if they were tried, as in the experiment described by Mr. Humphreys. If we had a yellow flame here, and a white flame there, and so adjusted their relative strengths that they gave equal illumination upon a surface intermediate between the two, then if we moved them both equally away from the surface, the illumination would remain equal on that surface.

Mr. Lowe—Notwithstanding the color of the light?

President Morton—Notwithstanding the color.

Mr. Lowe—Then you do not think that a 16-candle coal gas is better than a 20-candle power water gas?

President Morton—No; I should not think so, as a matter of mere illumination.

Mr. Boardman—In testing the candle power of different flames, did you ever observe the relative size of those flames necessary to give the candle power?

President Morton—Yes.

Mr. Boardman—Then I should like to ask whether the yellow flame requires a larger surface or a smaller one, or a surface of the same size, in order to give the same candle power by the photometer?

President Morton—The yellow flame undoubtedly requires a larger surface to give the same amount of light as compared with a white flame. In other words, a white flame, from the nature of things, has a more intense action. And that reminds me of a point which I think will interest you. A great many years ago Prof. John W. Draper, of this city (now dead), who was one of the most original of American scientists, went into this subject and investigated it thoroughly. He found that where a body was rendered luminous by heat, as, for instance, a platinum wire, this was the order in which the colors appeared: When it first became luminous the rays were entirely red; as it became more luminous, there were added, to those red rays, yellow rays; but the red rays were also increased. There came more red light than before with the yellow light added to it. Then, as the heat was increased still more, the red was increased, the yellow was increased, and there was added to them green rays. As the heat was still further increased there was added to the green, blue; and to the blue, violet; but, with each addition of the higher colors, the amount of the light of the lower colors was increased. In other words, we find that in order to get up to such a compound of colors as will give us the white light—that is, a compound which must have in it blue, and violet, as well as the others—we must have a great amplitude of motion or intensity of the lower ones as well as of the higher. In still other words, when we get the white light it is by having a very intense, or very powerful vibratory action, or the amplitude of the longer waves must be great in order to bring the shorter waves out so as to produce white light.

The President—I do not see that there is very much left for the adherents of coal gas, theoretically; but I think that some of us are still unconverted. It seems to me, to put the thing in this way, that, theoretically, if you will take 5 feet of 30-candle gas you ought to get from it as much light as you would from a larger burner, burning 10 feet of 15-candle gas; or as you would get, from the same amount of gas, from two of these Edison burners. Now, as matter of fact, I believe that if you should compare the light upon a surface which was lighted by a large flame burning 10 feet of coal gas, with that lighted by a flame which was burning 5 feet of 30-candle gas, you would find the room would be better lighted by the 10-foot burner. It seems to me there would be more diffusion in the room; although, theoretically, I do not know that I have any reason to give for it except the size of the flame.

President Morton—I think you are correct, theoretically as well as practically, up to a certain limit. In order that a gas with half the intensity of illumination should produce the same total amount of light, there must be a double area by which the light is produced. That, of course, will diminish the sharpness of the shadows. When we are speaking of single lights it is manifestly true that if you have a light which is one square inch in area, and are getting from that a certain total amount of light, and then get the same number of candles from two square inches of light, the intensity must be diminished proportionately; half the intensity involves double the area. With this double area you are getting a better diffusion; it will go more around the columns; it will better light up spaces that otherwise would be shaded; it will diminish sharpness of the shadows, etc. That is undoubtedly true. In practical illumination, however, we are dealing generally with a number of lights. It is very rarely that we attempt to light a room from an absolutely single source. Where we are dealing with a number of lights, and multiply the number of lights when you reduce the intensity, then we are gaining in both ways; because, of course, it is easier to light a space by putting two lights a quarter way from each end than by lighting with one light in the middle, for this law of decrease in proportion to the square of the distance makes it disadvantageous to light from a single source. In any case in which distribution by breaking up one light into several comes in, of course there is great advantage in a number of sources of light as compared with a single one. But I do not think, aside from this, that there is a difference if a given area (say a square inch) is given, of 20-candle power, and that light is falling on a plain surface, and another of two square inches, which is also giving off a 20-candle light, which falls on that same surface. Then I cannot conceive that there can be a difference of illumination, except such as may be due to the different colors of the lights. One may illuminate with a pure white light; another may illuminate with a yellow or reddish light; and one or the other may be agreeable; and one or the other may light a surface, if it is a colored surface, very much better than the other. If a majority of the objects are of yellow color, a yellow light will illumine them much better than any other color. If those same objects were blue, then a yellow light would be feebler in its illumination. If we had a room of more chromatic color, all red or all yellow, we could then best light that room with a light of a corresponding color; but, if a room is decorated with all sorts of colors, then the whitest light that we can get—the nearer in fact we can approach to daylight—the more distinctly all the colors will equally appear.

Mr. G. Wood—There is one point I would like to introduce here. Some years ago a party came to New Bedford, Mass., who wanted to light the city streets with oil. He said that he could produce a light better than the gas light produced by a 4-foot burner, and could do it a great deal cheaper—so much so, that it took the mind of the Committee on Street Lighting, and they adopted the plan for a year instead of using gas. Some of the citizens said that the streets were better lighted with it than they had ever been before, but we soon determined that they were not so well lighted as they had been with gas. Perhaps we were a little selfish about the matter. However true or not the latter may be, we tried to get one of their lanterns in order to test the light in comparison with gas. They would not let us have one. We used a little stratagem, sent on to New York, and by reason of passing the order through two or three individuals, without their knowing where the lamp was to go, we obtained a lantern and also secured a quantity of the oil they were using in the lighting of the city. We put that lantern up in a building, lighted it, and then started up one of our gas lights close by. We next invited the Committee on Street Lighting to pay us a visit. On entering the building they first saw the oil light, and then looked at the gas light. They said right away that the oil light was the best. Then we tried the lights with the photometer, and found that while the gas light, burning 4 feet, was giving a 13-candle light, we could only get 7.5 candles from the oil light. Any unprejudiced person could see, simply by looking at the two lights, that the photometer told the truth; but the Committee declared that the oil gave the best light, and we were likely to be defeated in our contest. I finally said I wanted them to make a simple practical test. Taking out of my pocket a small almanac which was printed from small type, I asked them to read that print at as great a distance away from the oil light as they possibly could, and then to go through the same process with respect to the gas light. They tried both suggestions and found they could read the print, by the aid of the gas light, at twice the distance possible by the aid of the oil light. They all tried it, and all reached the one conclusion. Then they gave up the contest.

Mr. Edgerton—I understood that the starting-point of this dis-

cussion was the assertion that 16-candle coal gas illumined as well as 20-candle water gas. I desire to call your attention to a practical illustration—a case of illumination in London, England, where they have a 20 or 21 candle cannel coal gas and a nominally 16-candle common gas ; and yet, as a practical test, the cannel gas is sold at 4 shillings, whereas the common gas is sold at 2 shillings and 3 pence.

On motion of Mr. Clark, a vote of thanks was tendered to Messrs. Humphreys and Jones for their papers.

Mr. A. C. Humphreys—I wish to say, before moving a vote of thanks to President Morton, and before the discussion on this subject is closed, that last night I made a practical experiment, not a scientific one, in my own room with two light-giving surfaces, one being perfectly white and the other being a very mellow yellow. I tried with the photometer to test the illumination from the same candle power. So far as I could see, they were of the same size, made from the same materials, and practically the same. The lighting effect in the room, as we speak of it, from the yellow flame appeared superior, as it certainly was more pleasant to the eye ; but when I asked some of those with me to read print at a certain distance from the light, they could read it with the white light the best.

I move the thanks of the Association to President Morton for his very interesting remarks upon this subject. I regard them as a practical lecture, covering some very important features, and I think that, if we deserve thanks for our papers, President Morton most certainly deserves our thanks for his address.

The President—I understood that in voting the thanks of the Association, we included all three of the gentlemen who we had the pleasure of hearing, but I am very happy to put a motion tendering a special vote of thanks to President Morton for his entertaining remarks.

The motion prevailed.

Mr. C. H. Nettleton, of Birmingham, Conn., now read his paper on the subject of

UTILIZATION OF RESIDUAL PRODUCTS.

Unfortunately the Committee appointed by your Association to appoint certain members to prepare papers for this meeting selected the speaker as one of the victims. It was unfortunate in a double sense for the Association, as a better selection could easily have been made, and a far better paper been listened to than the one you will now hear ; and unfortunate for the speaker, as the press of business has been so great with him this fall that sufficient time could not be spared to give the subject named by the Committee the thought necessary, or the few thoughts he had the proper expression. I dislike to offer the Association an apology after promising to write, but it has been impossible to prepare a paper worthy of the subject or the occasion.

The notice which I received from our Secretary stated that I had been appointed to prepare a paper on the "Utilization of Residual Products to cover the probable return, not only in my own immediate neighborhood, but from other sections as well."

While thanking the Committee for the compliment implied by the appointment, yet it has seemed to me that they laid out a very large subject for one person to write about—so large that the time at my disposal did not warrant the undertaking, and in consequence I have ventured to change the subject somewhat, and shall treat simply of the Residuals of a Coal Gas Works.

What I desire to call your attention to is not so much the value of residuals in themselves—with that you are all familiar—but to the probable revenue that can be derived from them ; to the necessity of paying a large amount of attention to their sale, and to point out some methods followed successfully by some companies with which the speaker is familiar in disposing of these bye products. In the first place, what can be derived from the sale of residuals in a coal gas works ? It is a fact that in a large European works the entire cost of manufacture is paid for by profits derived from the sale of coke, tar, and ammonia water, and their products, so that the gas in the holder costs absolutely nothing.

At the other extreme is the small works poorly managed where the tar runs into a convenient sewer or river, where nearly all the coke is used in heating the retorts, and where at the end of the year the total returns from residuals amount to fifty cents per ton of coal carbonized, or less. Between these extremes there is a wide margin. Few of us, perhaps none, can ever expect to reach the high results of the foreign company referred to, but all of us, it is to be hoped, make a better return than the last named.

How shall the sale of residuals be expressed ? If in so many hundreds or thousands of dollars, it means nothing unless the size of the company be known. If in so many cents per thousand feet, the statement is misleading, for the reason that the price received for coke, which is by far the largest item, must depend entirely on the local price of fuel. For illustration : Suppose A is the manager of gas works in a city where the cost of the coal for domestic purposes is $6.50 or $7.50 per ton—he may be able to obtain 11 cents per bushel for his coke, and if he sell 15 bushels per ton of coal carbonized, the receipts would be $1.65. B, on the other hand, manages a works where good coal for domestic purposes is sold at $2. He sells, let us say, 25 bushels per ton of coal carbonized, but can receive at most but five cents per bushel, or $1.25. If expressed in thousand feet sold, and each sells 10,000 feet per ton, A would receive 16 1-2 cents per M. and B but 12 1-2 cents, and yet B manages to sell 67 per cent. more coke per ton than A.

It seems to the speaker that the proper way to express sales of residuals is in percentage of cost of coal carbonized. This gives an intelligent statement at once of the results reached, and enables us to compare results with others in the fewest words, and in the most comprehensive manner possible. The coal has cost one hundred per cent., the returns from residuals are fifty, sixty or seventy per cent.

In the case of A and B referred to before, A would probably pay $5.50 per ton for his caking coal, for with high prices for domestic coal, gas coal is almost invariably correspondingly high, and vice versa, and his receipts for coke being $1.65 per ton would be thirty per cent. of cost of coal carbonized. B, on the other hand, would undoubtedly purchase his coal for $2 or less—and his receipts being $1.25 per ton, would be sixty-two per cent. I submit to your judgment if these percentages, thirty and sixty-two, do not more nearly represent the comparative working of the two managers, so far as relates to coke, than can be expressed in any other way.

Let me say frankly that I started in the preparation of this paper with the hope of proving that in most works well managed, the residuals could be made to pay 90 per cent. of the cost of the coal ; but here on the seaboard, and through New England, with good caking coal costing from four to five dollars per ton, I have very reluctantly come to the conclusion that most of us must content ourselves with 70 to 80 per cent.

But what does this mean in this part of the country ? Let us assume that the cost of coal including cannel or other enriching material is $4.30 per ton in the coal shed. Seventy per cent. of this will bring an income of $3 from each ton carbonized, and if the capital be no larger than $60 per ton of coal used or $6 per thousand feet sold, the income from residuals will pay 5 per cent. on the capital.

Can this standard be reached under ordinary conditions ? I believe it can, and the fact that better results than 70 per cent. are obtained at one works on the seaboard here, and results reaching closely to 100 per cent. in a Western city where cheaper coal is obtained, ought to be all the proof needed that my statement is not exaggerated.

In the order of value the residuals can be named coke, tar, and ammonia.

First—Coke, and how much can be obtained from it ? The answer to this depends on the quantity saved, the rapidity with which it is sold after being made, and the price received.

First—The quantity saved. This in turn depends on the settings for the retorts, and whether regenerative furnaces are employed. All will agree, I think, that no gas manager can afford to use a poor setting or a poor stack ; the waste of heat and consequent waste of money are too great ; but all may not agree with the desirability of using regenerative furnaces. After an experience of seven years, I unhesitatingly say that I am strongly in favor of these furnaces, and one of the principal reasons is the larger amount of coke left for sale than with the ordinary setting. It is well known that certain gas works using furnaces are selling 30 bushels of coke per ton of coal carbonized. The day when a gas manager can rest content in selling 15 or 18 bushels of coke per ton has passed, and 25 to 28 bushels, or higher, must be the standard.

Second—The rapidity with which coke can be disposed of affects to a large degree the quantity, provided of course it is sold by measure and not by weight. If a pile is allowed to accumulate and the coke handled over a number of times, the consequent shrinkage in bulk is very great, reaching, so I am told, to as much as 30 per cent. Coke should be sold, if possible, as fast as made. If customers do not come and leave their orders, then seek the customers; devote time and energy to its sale. Push it with the same enterprise that we use in selling our gas, and the results sought for are sure to follow. I have in my office a large poster which has been used very successfully by a New England Gas Company. With an accumulation of coke in their yards, the bill boards, dead walls, and fences in the city where that company is located are covered

with that poster, with coke and its virtues printed in glowing colors, so that he who runs not only may but must read. The result I am told is invariably the same, the demand increases, and the surplus disappears, and that too without lowering the price.

Third—The price at which coke is sold. It is the fixed belief of the speaker that the same price per pound or per ton ought to be obtained for this product in every place, as is paid in that place on an average, for a good quality of steam and house coal. I believe this because some careful experiments at the gas works in my charge convinced me that a pound of coke would evaporate a trifle more water than a pound of coal, and because (and this perhaps is the most convincing proof) I obtain that price and have done so for years, almost without exception.

The experiments referred to were made in an upright tubular boiler: 7.36 pounds of water were evaporated with a pound of good anthracite coal, and in the same boiler, under the same conditions 7.55 pounds of water were evaporated per pound of coke. Or expressed in dollars—if the coal were worth $5.00 per ton of two thousand pounds, coke would be worth $5.13 for the same quantity.

The price at which coal has been retailed in the town in which the speaker lives, has varied from $5.00 to $6.00 per net ton for a number of years. And the price of coke has been fixed at nine cents per bushel in the yard or ten cents delivered within a mile of the works for the past six years, and has not been deviated from except on rare occasions. As a Winchester bushel of dry coke weighs about 37.5 pounds there are 53.3 bushels in a ton of 2,000 pounds, and at 10 cents per bushel, the price received for coke must have been $5.33 per net ton. As the cargo prices, or those at which the manufacturers buy their coal are much lower than the retail prices, I think that the statement made above is fairly proved that the company with which the speaker is connected has received for its coke the full average price at which coal is sold in its neighborhood.

I have been told that the company is very fortunate to be able to obtain such a price for coke, and probably that is a fact; but back of the good fortune lies a great deal of labor, and the price is as much the result of hard work as any other successful enterprise is the result of well directed thought and effort. Besides other companies in New England receive the same or higher prices. Our Secretary can if he will, tell you of one which receives on an average ten cents per bushel for broken coke; a neighbor of his receives about the same price; another exceptionally situated, receives 12 1-2 cents per bushel, and so on.

In selling coke there are a few essentials which to the writer seem quite important. Have a fixed price, "like the law of the Medes and Persians which altereth not." Make it as high as you think the market will bear, and then adhere to it. Nothing will destroy a good coke trade so quickly as a rise in price. Seek a house trade, it is the most reliable in many ways, and can be depended on to last better than almost any other; and one great point in its favor is the fact that it varies in its demand almost directly as our production of coke—being heaviest in the winter, and lightest in summer. To secure this trade it is a matter of necessity to break the coke—without that, the attempt will be a failure, for nothing but a coal famine will force any large number of people to try to use the large lumps of fuel in their cooking stoves, which we haul out of our retorts.

The breaking of coke seems to be quite a bugbear to some of our ablest members—and yet in small works with hand hammers or in large works with machines, the breaking can be done at a very slight expense.

These gentlemen claim that between the labor, the shrinkage and the breeze produced, it would be as well to sell the coke for a very small sum. The answer to this is, to charge a sufficiently higher price for the broken coke to cover these items. The speaker has sold broken coke at eleven cents per bushel in yard, or twelve cents delivered, for a number of years; and from some careful experiments the following results are arrived at:

100 bushels of large coke is worth at 9 cts., $9.00; when broken it makes 85 bushels small coke worth at 11 cts., $9.35; and 7 bushels breeze worth for steam, at 6 cts. 42; total $9.77—leaving an excess of 77 cts. to pay for labor in breaking, which more than covers the cost.

In this connection it may be of interest to relate a personal experience which happened this past year. From some changes in the retort house, a larger quantity of coke was saved last year than ever before, and during the present year a still larger quantity was expected. The question naturally came up how can a market be be found for this surplus coke? The factories were tried without success, and finally it was decided to work up a house trade if possible. Various means were resorted to, posters, advertisements in papers, circulars, etc., till finally a card was sent out in February last, which on one side read as follows:

At the following prices, small coke will be delivered and binned on any floor of any building within one mile of Gas Works:

2	bushels,	$0.36	14	bushels,	$1.79
3	"	51	15	"	1.90
4	"	66	16	"	2.01
5	"	80	17	"	2.12
6	"	91	18	"	2.23
7	"	1.02	19	"	2.34
8	"	1.13	20	"	2.45
9	"	1.24	21	"	2.56
10	"	1.35	22	"	2.67
11	"	1.46	23	"	2.78
12	"	1.57	24	"	2.89
13	"	1.68	25	"	3.00

The results can be stated in a few words. From March to September inclusive of 1886, 74 coke orders were received at the office, representing 2,930 bushels, and in the same months of 1887, 448 orders were received representing 9,293 bushels, and besides a larger quantity has been sold from the yard. So large has been the increase that it has been necessary to purchase some coke from a neighboring gas works in order to keep up with the demand. In this connection it can be stated that a careful account has been kept of the cartage. The excess on the prices quoted, above 11 cents per bushel have been credited to the carting, and it can be stated positively that no money is lost on that account.

Tar.—The question of how to dispose of tar to any profit is a very difficult one for many companies to answer satisfactorily. It is well understood that to put up a tar distillery, and run it successfully, needs a product of such an amount that few works in this country can undertake it. The tar can be sold to the tar distillers, who of course have to make a profit, and in consequence can offer only a small sum, small compared to what we would like to obtain; or it can be sold to rubber factories to be made into "pure gum" shoes; or to the electric light carbon factories to stick the particles of carbon together; or it can be sold to the tar-walk man. But all of these, except the last named, involve transportation charges, which must in the long run be deducted from the price received for tar. It is desirable to have a home market for everything pertaining to a gas works, and that is especially the case with coal tar; without it a small amount only will be received for this product—with it a price can be obtained which will net the company from 50 to 75 cents per ton of coal carbonized. All through the western part of Connecticut tar side walks are very popular, and in some towns, stone or brick are the rare exceptions. As this makes the most desirable market that I have ever heard of, a description of the method followed in laying the walks may not be out of place, and may be of some assistance to the gas manager who has no market for his tar.

The space to be covered is leveled off about 3 1-2 or 4 inches below the grade of the walk and rolled, and if bordered by grass or desired to be confined, a board 1-2 inch thick and 6 inches wide is set up on edge along the sides. If the ground is of a sandy or gravelly nature, this is all the preparation needed; but if of loam, the soil must be excavated to the depth of two feet and the space filled in with stone, gravel, cinders or sand. If this is not done the walk when laid, will be sure to crack, and heave when the frost comes out in the spring. The material is prepared as follows:

If a gravel bank be convenient, stones from 1 inch to 2 1-2 inches in diameter are carefully screened out, tar thrown over them and the pile turned over, so that each separate stone shall receive its coating of tar. These are laid on the space which is already prepared for the walk, to the depth of three inches. They are then rolled with rollers weighing three hundred pounds and upward. Care should be taken that sufficient tar be used to cause the stones to stick well together, or otherwise the walk will disintegrate. The speaker has never seen it tried, but is of the opinion that broken stone would make a better walk than the round cobble stones which are generally used in Connecticut, as the rough surface of the broken stone would make a better surface for the tar to adhere to than the smooth surface of the round stones.

The "top-dressing" is prepared as follows: Coarse, sharp sand and fine coal ashes are mixed carefully together "dry," in the pro-

portion of one part of ashes and two parts of sand. The tar is then added, the pile turned over a number of times, each time being carefully raked, so that the tar shall thoroughly permeate the entire mass. Care must be taken not to use too much tar, as in that case the walk will be too soft; and on the other hand, if too little be used, the particles of sand will not adhere to each other. When thoroughly mixed the pile should have a dry, spongy appearance. This is now laid evenly on top of the first course to the depth of an inch and a half. It is then carefully rolled and the pressure of the rollers will reduce it to one inch in thickness, or a trifle less. The walk is allowed to stand for twenty-four hours without being used, and is then ready for public travel. The prices asked by the tar walk men vary from fifty to ninety cents per square yard, but it can be truly said of the quality that the walk is very apt to vary with the money. If the former price be paid, a walk will be laid that will last for a few years only, for the latter a walk *can* be laid that will last 15 or 20 years with ordinary use; and then for repairs need only have a renewal of the top course.

The speaker has found it necessary, in order to sell tar for this purpose, to divide that produced at his works into two qualities. All condensing in the hydraulic main, and hot tar scrubber is sent into one well, all beyond that point, in the exhauster, condensers and standard scrubber, into a separate well. For the first he has had no difficulty in obtaining $3.00 per barrel, for the second $1.50 per barrel, averaging $2.50 per barrel, each holding fifty gallons.

If my company had no demand for tar, and could not develop one which would bring a fair price, I should certainly burn it. Tar is worth to burn under the retorts one-half the price of a bushel of coke, and that fixes the price under which I will not sell it, so long as the matter is left in my hands. If all the gas companies in the country could be induced to act on this idea, and one-third or one-half of the tar produced were consumed under the retorts, there would be little difficulty in obtaining a reasonable price for the balance. As you know this course is recommended, and practiced by one of the leading gas engineers in England, Mr. George Livesey, and I would commend it to the careful consideration of every gas manager who fails to obtain a good, round price for his tar product.

Ammonia.—Until very recently most of those present allowed their ammonia water to run to waste, but thanks to some of our friends in the ammonia business, a plant has been developed in the past two years for concentrating ammonia water with very little trouble, and at slight expense, from 7 or 8 ounce liquor to 60 and 70 ounce strength. By this means a great weight of water is gotten rid of, and it is now possible to ship the concentrated at a profit, where before the freight charges would have left the balance on the wrong side. By this apparatus, companies carbonizing 1,500 tons annually or even less, can obtain a return from this residual. The cost of operating the concentrating apparatus belonging to my company is:

For labor per day, not over,	$1.00
For additional coke used in boiler, 5 bushels at 9 cts.,	45
	$1.45

In addition to this some additional breeze is used to make the steam required, but it has not been included. There are besides the items of interest, depreciation and repairs. A run of eight hours will work off 600 gallons of 8 oz. liquor, and will produce about 75 gallons of 60 oz. liquor. This will weigh about 650 pounds, and can be sold at prices which will vary with the location of each place. From what I hear there is no difficulty in a contract being made that will net 18 cents per ton of coal carbonized.

It is proper to state, however, that the concentrator will not work well with less than 5 oz. liquor, and a higher strength gives better results.

And now gentlemen, I have nearly done. I am afraid some of you will think I have been indulging in the possible, and not the probable return from residuals and some replies received from inquirers which are tabulated below, tend to confirm that idea.

	Bush. of Coke sold per ton.	Per cent. of cost of coal, cannel & oil rec'd from coke.	Price per bush. in yard.	Average retail price of coal.
1	—	16.78	.07 X	5.75
2	.73 of coke made	50	.05	2.50
3	—	25	.05	5.75
4	22	33	10 for broken	6.25
5	22.63	42	8.77	5.50

As these figures, with two exceptions, do not bear out the optimistic views presented in this paper, and as the weight of evidence is against me, I submit the following table to show the facts on which my faith in this matter is founded.

The sale of residual products at the works in my charge have produced the following percentages of cost of coal and cannel (no oil is used) for the past five years. In all cases the cost of delivering the coke is deducted. The labor of breaking coke is deducted only in part, but at most this item is small during these years. The labor of pumping tar is not deducted, but the labor and all charges connected with ammonia are.

For year ending April 1st,	1883,	47.8 per cent.
	1884,	46 "
	1885,	57.5 "
	1886,	54 "
	1887,	57.6 "

As the company is now selling six bushels of coke more per ton than last year, and as this additional sale will add more than 10 per cent. to the figures of 1886, it is safe to claim that the residuals are now paying nearly 70 per cent. of the cost of coal carbonized.

I trust you will pardon the length of this paper. It has grown much larger than I wished or expected—as you probably have discovered it is a subject in which I take great interest, and it is not impossible that I exaggerate its importance; but I feel confident that if the dollar problem which our Mr. Greenough gave us years ago as being the great problem of the day among gas men—if this problem be ever solved in this part of the country, it must be done by working up the receipts from residuals to the highest possible point. With success there the problem may be solved successfully—without success it never can be.

Discussion.

Mr. Pearson—Mr. Nettleton spoke very favorably of the results obtained from the regenerative furnace, with reference to the quantity of coke obtained from a ton of coal. I would like to ask him if he obtains as much tar, and if the tar is of as good a quality as that obtained by him previous to using the regenerative system?

Mr. Nettleton—I am unable to answer that question positively. For years I have been figuring that a ton of coal yields 14 gallons of tar, because my sales bore out those figures. That allows 3 1-2 tons to each barrel of tar, of 50 gallons. I think, however, that with higher heats, a somewhat smaller quantity of tar would be made. I did not notice any difference in the quality of the tar in the matter of its use for tar-walk purposes. The hydraulic main tar is somewhat thicker, and the tar-walk makers think it is somewhat better for their purposes. Certainly they do not complain of it and it is being used very generally in my neighborhood.

Mr. Pearson—You do not speak positively as to how much less you obtain; but you think you get nearly as much?

Mr. Nettleton—I think that I get nearly as much, but I cannot speak with positiveness.

Mr. Pearson—Do your tar-walk makers heat the tar before using it?

Mr. Nettleton—In cold weather, when it is impossible for the tar to run, and they cannot work it as they need to do in mixing it with the materials employed, they heat the tar, but in summer they do not.

Mr. A. C. Humphreys—Do they dry the ashes and sand which they use?

Mr. Nettleton—In wet weather they dry the sand, and, I think, dry the ashes; but, as they ordinarily work on bright days, they use the sand just as it comes out of the pit, and the ashes as they come from the cellars, screening out the coarse particles. When they lay pavements over which horses and wagons are to be driven, they put in a lower course of coarse stones, and in the top course use some soft pitch. What percentage of that is used I do not know. For ordinary pavements they do not use the pitch. They merely use the tar, and without heating, except in cold weather.

Mr. Clark—Does not that soften in warm weather?

Mr. Nettleton—If the pavement is laid in the spring it will be somewhat soft the following summer, but by the following year it will be very hard.

Mr. Lowe—Did I understand you to say that a ton of coke is worth 13 cents per ton more than a ton of coal for the purpose of generating steam in boilers?

Mr. Nettleton—Yes; in my opinion.

Mr. Lowe—It seems to me that that touches somewhat the point which the Secretary has been so anxious to hear something about—the generation of steam from coke. Can you give us some idea of that?

Mr. Nettleton—I have given you the results concisely.

Mr. Lowe—Were the price of coal to go down, then the results would be in favor of coal, rather than in favor of coke, as I understand your paper.

Mr. Nettleton—If the prices of coal go down, then the price of coke must drop correspondingly; but the coke is worth a little more than coal.

Mr. Lowe—You stated that the price generally received for this

hard pavement was from 50 to 90 cents per square yard. I have just paid 30 cents for a lot of this work.

Mr. Nettleton—I doubt if that work will last.

Mr. Helme—You will recollect that, at our meeting in Boston, an effort was made by members living west of the "Hub" to have 2,000 pounds designated as the weight of a ton of coal. Mr. Slater does not seem to be here now, but you may recollect that he calculated it for 2,240 pounds. You will also recollect that no two gentlemen connected with New England gas works would agree as to the number of bushels of coke they got from a ton of coal. Is not that so?

Mr. Nettleton—I was not there; but, nevertheless, that is a fact.

Mr. Helme—I will say this, however, some claimed to get as high as 43 bushels of coke to the ton, while others put their estimate at as low as 30 bushels. These figures were so far from what I had been used to obtaining that I did not say anything about it. My preference was for placing the weight of a ton of coal at 2,000 pounds; but 43 bushels of coke, from a ton of coal, was what disturbed me. I know that a resolution was passed to the effect that whenever we were discussing the subject of weights and measures, we reckoned on the basis of 2,240 pounds to the ton, and 2747.7 cubic inches to the bushel of coke. Although Mr. Stiness could make more coke than all the rest of you, he only got 40 bushels of coke out of 2,240 pounds of coal. I do not see how you can get 53 bushels of coke out of 2,000 pounds of coal.

Mr. Nettleton—In answer to Mr. Helme I will say I have used 2,000 pounds to the ton simply because I was comparing the price of coke with the price of coal; and coal is always sold for home use in our city by the ton of 2,000 lbs. I did not say that I got 53 bushels of coke to the ton of coal. I said that there will be in a ton of coke 53 bushels.

Mr. Page—In an address by Dr. Siemens, delivered before the British Association some six years ago, he stated, what was then a fact in the case of one coal gas company in England, that the receipts for residuals—coke, tar, ammonia and sulphur—paid the cost of putting the gas in the holder. Five years ago, when ammonia and ammoniacal liquor of 8 ounces sold in England at an average price of 60 cents per ton of coal carbonized, coal tar was selling at 65 cents per ton of coal carbonized. Therefore, and in the case of many companies, more than the cost of the coal was obtained from the residuals. Why has there been such a change in the value of the two residuals? In the first instance, the vast increase in the production of anthracene and benzole from coal tar, by which the value of the benzole and the anthracene was diminished, and the vast increase in color manufactures in Germany, Switzerland, Belgium and in England, caused so great a reduction in the value of the coal tar dyes that the market price of coal tar fell from 65 cents to the present price in England of about 25 cents per ton of coal carbonized. In this country, singular to state, a larger average price is being obtained for coal tar than in England, because of the wider uses of the products. Pitch is being used so much more largely here for roofing, and for paving, and creosote oil for wood preservation. The light products, to some extent, are increasing in value; but as the values on the other side are so low that it does not pay to export the benzole and anthracene, our manufacturers receive nothing for the latter once very valuable product, the base of artificial madder. Yet, with the advance in chemical industry applied to the use of coal tar products, and to the manufacture of new products on the other side, in Germany especially, where technical schools have been educating their young men in this line for 25 or 30 years, to-day not less than 2,500 bright and intelligent men are employed exclusively upon some one or more of the local tar products.

Professor Baeyer has produced artifical indigo, synthetically, which is being imported, sold and used in this country to-day at $20 per pound, when the price of vegetable indigo is $1.50 and $1.60 per pound. Why? Because it gives a brighter and more distinct color, and, therefore, can be used for certain purposes where the vegetable indigo cannot be used so advantageously. By cheapening the modes of producing it, which will doubtless be accomplished in due time, competition with indigo for all its varied uses will be possible. Then the fifteen or twenty million dollars per annum now paid for indigo will be paid for this product from coal tar, just as to-day the artificial madder has displaced every acre of natural madder grown in the world.

A most interesting discovery has been made in our country, and mainly by a distinguished American chemist. I hold in my hand a sample of saccharin. A letter just received by me from Dr. Ira Remsen, of the Johns Hopkins University, of Baltimore, gives its history as follows:

"The facts in regard to the substance commonly called saccharin, are simply these: During the year 1879 a Russian, by the name of C. Fahlberg, was working in the laboratory of the Johns Hopkins University under my guidance. At his request I suggested to him a line of original investigation, which was a continuation of some work I had previously done, the result of which had been published. He undertook the work and was constantly under my guidance. When the work was completed I wrote and published an article giving an account of the results, and describing the sweet substance under the name of benzoic sulphinide. As is the custom in all scientific laboratories of the world, I placed Fahlberg's name with my own at the head of the article. This kind of partnership is perfectly understood by scientific men. The article to which I refer was published in the *Berichte der Deutschen Chemischen Gesellschaft*, XII., 469 (1879). Afterward, in January, 1880, I wrote a second and more detailed article on the subject, and this was published under my own and Fahlberg's names in the *American Chemical Journal*, in April, 1880, Vol. I., page 426. Since that time I have, with the aid of advanced students, continued my investigations of the substance, and have published other articles on the subject. In the meantime it appears that Fahlberg has occupied himself with devising methods for preparing the substance and has patented it without consulting me. This I object to; and all who are familiar with the facts recognize that Fahlberg is entirely unjustified in appropriating the results of our joint labors. My opinion is that he has acted dishonestly in the matter."

The famous chemist, Sir Henry Roscoe, President of the British Association, pronounced saccharin 220 times sweeter than sugar. While we cannot say that that is going to displace the cultivation of the sugar cane, yet it is claimed that in medicine the product is invaluable. Saccharin does not assimilate and therefore can be used where sugar cannot be. The manufacture of it, which ought to have been begun here, and which rightly belonged here, is conducted in Germany. The Russian went to Germany, obtained a patent for the invention, is manufacturing the product there, and sending it back to this country. It sells at retail for $2 per ounce. I also exhibit another product, antipyrine. Some of the best scientific authorities in the world say that this is a more powerful febrifuge than quinine. It has no bitter taste, and it works more quickly. It is now being made and sold largely. Another product, salol, is used in medicine in increasing volume as a remedy for rheumatism. But one of the latest and most interesting discoveries is thalleine, which has been used successfully in fevers, and is a curative of yellow fever. Oil of myrbane, having the odor of the oil of bitter almonds, is made in this country. I have here cumarin, identical with the extract obtained from distillation of the sweet-scented grasses, known in perfumery as "new mown hay." It is made from coal tar. Let me impress upon you that while we have not these industries now, they are coming; because the introduction of skilled talent in the gas industry and other manufactures will enable us, by and by, to establish here that enormous color industry, and other chemical industries, which are now held firmly in the grasp of Germany. Let me say a word on the subject of ammonia. That is increasing in use very largely, especially for artificial refrigeration. There are to-day in this country not less than 1,500 artificial ice-making machines. The number is increasing at the rate of 200 a year. Cities, towns, and even villages in the South, United States forts and naval vessels and ocean steamships are introducing that mode of producing ice and cooling, because it is cheaper and better, and gives a purer product, than ice obtained from the North River, or from any of the northern lakes. The residual from gas-making furnishes the cheapest and best source for obtaining the ammonia which is used, not only for this but for so many other purposes. There will be a steadily increasing value for that product. Therefore, there is certainly encouragement in knowing that in the near future the coal in the coal sheds will be paid for by the products obtained therefrom.

On motion of Mr. Clark, a vote of thanks was tendered to Mr. Nettleton for his interesting paper. The Convention then adjourned to reconvene on Thursday, October 20, 1887, at 10 A. M.

SECOND DAY—THURSDAY, OCT. 20—MORNING SESSION.

The Association met pursuant to adjournment.

PLACE OF NEXT MEETING.

Mr. Clark—The Committee appointed to select the place for holding the next meeting of the Association recommend Toronto, Canada. They originally desired to go South, to Atlanta, Nashville or Louisville, but as they received a very cordial invitation from Toronto they decided to accept it. I will read the letter of invitation:

"CONSUMERS GAS COMPANY, TORONTO, ONT., Oct. 15, 1887.

"C. J. R. HUMPHREYS, ESQ.,
"Secretary American Gas Light Association,
"Sturtevant House, New York.

"My Dear Sir: As it is possible that I shall not be able to attend the meeting of the Association until the afternoon of Wednesday, the 19th inst., and fearing that some decision may be arrived at before then, regarding the place of meeting next year, I write to say that our President, Vice-President and Directors have unanimously and cordially authorized me, on behalf of the Company, to extend to the Association a hearty invitation to hold their next meeting in the city of Toronto.

"We trust that as the Association has never met in Canada, and as we hope to have finished by that time a works that will not be unworthy of inspection, and as our city possesses many objects of interest, that this invitation will be favorably entertained.

"I assure you that we shall do our best to entertain the members of the Association, and to make their sojourn as pleasant as possible.

"As the weather here is somewhat colder toward the end of October than in the latitude of New York, I would suggest that, if practicable, the meeting take place in the first week of October, when it will be pleasanter weather for driving.

"Sincerely yours, W. H. PEARSON."

The President—Does the Committee make any recommendation with regard to the time of holding the meeting?

Mr. Clark—The Committee recommend that the meeting be held, as Mr. Pearson suggests, in the first week of October.

The Secretary—The Constitution provides that the meeting shall

be held on the third Wednesday ; and we cannot amend the Constitution except in regular form, or by unanimous consent. This has been done once before—at the time of the Chicago meeting—when it was found desirable, by reason of a political convention being held in Chicago, to have our meeting on the second Wednesday instead of the third.

The President—I think we may, by unanimous consent, agree to hold our meeting at the time suggested. The invitation which we have received from Toronto is certainly extremely cordial ; and, if desired, I will put the question whether we will accept it, and at that date.

Mr. Boardman—Do I understand you are going to put the whole question, or simply the question as to the place of meeting ?

The President—I will put it either way—separating the questions if you desire it.

Mr. Boardman—Then I wish you would divide the question, because there are very strenuous objections which might be advanced for not having the meeting quite so early.

The President—Then I will first put the question of the acceptance of the invitation to meet in Toronto, in accordance with the report of the Committee.

The invitation was unanimously accepted.

Mr. Huntington—I now move that the meeting at Toronto be on the regular date provided by the Constitution.

Mr. Boardman—I second that motion. As we meet for business considerations mainly, and want to have as many present as possible, we ought not to consider the weather, nor should we let any other consideration looking to our pleasure stand in the way. I think by meeting early in October a great many of us would be prevented from attending. Most of us have quarterly reports to make out in the first week in October, and, therefore, could not attend at that time.

The President—Does the Committee change their recommendation as to the time of meeting ?

Mr. Clark—Yes ; since it is a Constitutional matter. I did not remember that the Constitution said anything on the subject. As far as the convenience of our members is concerned, it seems to me that the early part of October would be more convenient than the latter part.

The President—It is obviously impossible to change it if objection is made.

Mr. Clark—Of course, if there is objection, that ends it.

The President—Then we will meet at the regular time in October in Toronto.

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

Mr. Taber—The Committee to whom was referred the President's Address make the following report with reference to the suggestion of the President as to the formation of a Committee of Investigation, so to speak. The idea of the Committee was to undertake it at this meeting, if possible, as a tentative plan, and to appoint a Committee which shall make a report upon its work, and advise next year as to a permanent organization. They make this report :

"A Committee should be appointed sufficiently large to have one member at least in each of the larger geographical divisions of our field of work. Each member should then be called upon for advice by those in his vicinity ; and any question arising which he cannot decide, or is not willing to take the responsibility of so doing, can be submitted to the entire Committee, and they in turn, if desirable, can submit it to the entire Association. Let us start at once, and, by the time when we shall meet again, this Committee can report upon its work and advise as to its permanent organization. We would recommend that the President appoint a small Committee to select proper names for the members of this Investigating Committee—one each from Canada, the Eastern States, the Middle States, the Southern States, the Western States east of the Mississippi River, the Western States between that river and the mountains, and the Pacific slope. This Investigating Committee to serve one year, and be allowed to draw, through its Secretary, upon the treasury of this Association for its necessary expenses, not exceeding $300, and report at the next meeting its work and a plan for permanent organization."

With reference also to the subject of badges which the President suggested, we recommend:

"That a committee of three be appointed by the President to invite designs for a permanent badge for the Association, to select from these designs the most suitable, ascertain its cost, and report to the next meeting."

They also recommend that a reprint of 800 copies of the President's Address be made and distributed among the members of the Association.

Mr. Clark—Do I understand that the Committee recommend the formation of a Committee by this Association to pass judgment upon all gas questions which may be submitted to them, for the benefit of local managers ?

The President—Substantially that.

Mr. Clark—I am opposed to it, and for this reason : There are men in this country who make a living out of gas engineering by giving advice, and this plan, if adopted and carried out, would effectually put an end to that living. It would put it in the power of any gas manager to call upon the best talent in the business, and, without recompense, get from him, as a matter of right, the best advice that he can give ; and not only call upon him, but also compel him to call upon others to assist him in giving advice. I think that will be a very bad principle to establish, and would effectually put a stop to all individual efforts to make money out of gas engineering in this country.

Mr. Amory—I move the adoption of the plan recommended by the Committee. In making this motion, I have no desire to trench upon the question which Mr. Clark has raised. I doubt very much whether the investigation proposed, being a local affair, would interfere in the way he suggests. Of course, the Committee is appointed to investigate certain matters relating to the production of gas, and to report upon the plans which are known uncommercially. No gas manager would feel that he had a right to obtain, at very low cost, the advice of such Committee, and he would undoubtedly employ such experts as are known in the business. I think, therefore, that the fear which Mr. Clark expresses would not be realized. I certainly hope that this Association will take some such course as is suggested. We, who are business men, and connected with gas works, would very much like to take some such concert of action. If there is any scientific investigation of value in the production of gas, or which will cheapen or improve the production, I think that the expert will come in for his share in the investigation and will receive his proper fee.

The President—I would remind Mr. Clark of the fact that this is a proposition upon my part to do what there seems to be a large demand for among gas companies. I understand that Mr. Egner received something like 100 letters from gas companies, agreeing to pay something toward the expense of a scheme such as he proposed. It seems to me this could be done and, without subjecting those gas companies to that expense, produce the same desirable results. Concert of action by the gas companies seems to be demanded. This is an attempt to do what he proposes, but to do it somewhat better, and also to benefit the whole profession by giving us at our meetings the results of the investigations, whatever they may amount to. I may say I agree with Dr. Amory, for I do not think the business of the expert is going to be done away with in this country, even if there is sufficient business to be done in that direction to keep an investigating committee busy.

Mr. King—As a member of the Committee appointed by the Western Association to consider Mr. Egner's paper, I may say that, in fact, I know very little about it, because Mr. Egner has taken the matter altogether into his own hands. I have seen him since, but for a few moments. Just before leaving home, he sent me some facts to be presented to the Association. I did not hear the first part of this discussion, but if pertinent, and if it would be interesting to hear them, I will present a few of those facts for your consideration.

The President—Mr. Taber, as chairman of the Committee, recommends the appointment of such a Committee as I suggested in my address.

Mr. King—Personally, I think your suggestion is preferable in every way to the plan proposed by Mr. Egner. I will read a few of his figures. [Mr. King here gave some facts in connection with the work that had so far been accomplished by Mr. Egner in the matter of the proposed Institute.]

Mr Clark—I wish to call attention to the difference between the Egner plan and the plan suggested by this report. Mr. Egner proposes the employment of an engineer, and the use of an experimental station. He proposes to try, practically, all the patents that are issued for the manufacture of gas. In this report the Committee propose the appointment of a Committee who shall give their advice as to the practicability of plans, but shall do so without trying them. There is a decided difference in the two methods. Mr. Egner would have an actual trial of a plan, but this Committee would simply give advice with reference to it. As I have said, men are making their living by giving such advice, and it seems to me a pity to take that method of making a living out of their hands. It places before every gas manager the temptation to obtain, at very little trouble and expense, whatever information he may desire to secure with regard to the conduct of his gas works.

Mr. Zimmerman—If I understand this system, it seems to me to be a good thing for the gas companies, but rather a hard thing upon this Association. If the Association has to stand the expense of these investigations the gas companies would be receiving all this information for nothing simply because the Association would be paying the expense of obtaining it. As there are a good many patents and improvements constantly brought to our attention, this Association would get a great deal of valueless, as well as a good deal of valuable, information; but that valuable information would cost them a high figure. Traveling expenses and the like would precede and follow the investigation of a valueless as well as a valuable patent. It seems to me the gas companies ought to pay the expenses of the Investigating Committee.

Mr. Harbison—I do not agree with the last speaker. Gas companies, as is well known to consumers, have become, practically, benevolent institutions. Why, therefore, should we depart, in this instance, from our benevolent custom, and detract from our reputation ? If, as an Association, we lend a helping hand to those who do not know as much as the representatives of the larger companies, we are simply carrying out the principle already established. I do not think it will be wise or fair to ask a poor, weak company (like the one that I represent) to pay the traveling expenses of members of a Committee, coming from all over the country, to investigate a matter for such a company. This Association has a large fund in the treasury, and they cannot do better with it than to help me. Then I will be willing to help my neighbor, over the line in Rhode Island, or somewhere else. I hope that the report of the Committee will be adopted, and that we shall try the experiment

suggested by them. Let us put up an experimental station, if it is desirable—I think it would be a good thing. Then the Committee will be able to give us information, from year to year, that will be of value to the oldest and to the wisest men who are here. It will be the concentration of the wisdom of this Association, simmered down into a report which will be of great value to us, and then let us have it put on record. I think one speaker is in error in saying that the Committee would not practically test the value of any improvement that might be brought to their attention. I do not see how they could make an examination of it and make a report to this Association, unless they had made such a test at some spot which might be decided upon. I think they would be quite as competent to do it as the average expert—the Committee would be made up of seven experts, and they would be supposed to possess the combined wisdom of the whole country. I misapprehend the performance of the Committee very much, if they did not carry a suction pump with them whenever they went to a noted expert, in order to take information from him without his knowing it, and so be able, upon that information, to make a report which would be of benefit to the profession. I hope the report will be adopted, and that the plan suggested will be thoroughly tested.

Mr. A. C. Humphreys—I am disposed to think, after some consideration, that the plan of Mr. Egner is quite impracticable; and it also seems to me that the method now suggested is rather cumbersome, although there are certainly some excellent ideas in it; but why would not the whole subject be covered by the more efficient organization of this Association? We, as the representatives of a great many companies, meet from year to year, and are doing more or less all the time in the way of investigation. If we could so organize and arrange that work as to have individual members devote time enough, year after year, to thoroughly digest the results of investigations made by the members of the Association, I think it would afford a much better prospect of advantage than the method suggested. For myself, I can safely say that I would have no time to serve on such a Committee; and I do not see how any busy gas man could. He would be called upon to investigate in respect to subjects that did not interest him at that particular moment; consequently he would not work so thoroughly, nor produce results as valuable as he otherwise would. We all know that a man is better able to do effective work on any line of thought if he is forced to it by some necessity or consideration at that particular moment. Such is human nature. But by this plan you may be called upon to make an investigation into something which, up to that moment, has been entirely thrown out of sight by reason of other considerations. I think the whole subject resolves itself just into this—if we determine to make this Association more efficient in investigating these subjects, and in keeping track of what our members are doing, there will be no necessity for anything of this kind. I recognize the value of one argument, and a strong one, which can be brought against that plan—it does not give a member the opportunity of finding out anything until the next meeting; but I do not think that there are any of us who would not feel entirely at liberty to call upon any member of the Association whom we thought particularly qualified to give an opinion upon any particular subject.

Mr. Boardman—In support of the recommendation of the Committee, let me say I think we are striving, by this very means, to reach what Mr. Humphreys has suggested as being so desirable—we are attempting to organize our experience. Individually, we are all making experiments, and individually we are all willing to give our experience to our brother members. This Committee will simply be organizing this experience, and bringing it properly before the Association in a digested form, and in which it can be better assimilated by the individual members. I would ask, if any subject comes up which this Association wishes to decide upon, does it not appoint a Committee to investigate it? Is this Committee composed only of men who are at the moment engaged in considering that particular subject? I think that that Investigating Committee would be capable of taking up any question which might be brought to them; and if they were not they would be possessed of information as to who they should call upon as a volunteer to supply what they lack. Would it not be cheaper, for the gas business at large, to have such an Investigating Committee, which would lay these facts before their representatives, many of whom have their expenses paid in coming to these meetings? We are here in the interest of our companies, and these companies pay our expenses, hence we want to get value received for them. I think this plan is a good one. I do not think it would be wise for us to wait until we can get up a perfect organization before trying any. I trust that the recommendation will be acted upon so that we may do something at once.

Mr. Amory—It seems to me that the argument and discussion brought out by this report of the Committee, and by the motion now before the meeting, is a little out of the course. As I understand the report of the Committee, it is not intended that this Committee shall be a committee of experts, for, if it were a committee of experts, the suggestion to pay them only sufficient to cover their traveling expenses would be ridiculous. As I understand the report of the Committee, it is a Committee to be appointed by the Association to act as a medium of exchange between those who have methods of making gas which are claimed to be improvements upon the methods now in use, and those who are engaged in the business. This Association is particularly interested in the interchange of opinions between members in different parts of the country. Of course, no Committee could act successfully if one member lived in San Francisco, another in New York, and another in New Orleans. The point made in the President's address is certainly covered by the recommendation of the Committee, and in the motion before the Association. I believe that we all feel a sufficient interest in the subject of making gas to prompt us to lay before such a Society of Gas Engineers all the improvements which may be made in various parts of the country. As an individual member of this Association, and representing a company of small means, I think this method of getting at the question is one which is favorable to the gas companies, and as favorable to the experts who are interested in promulgating new ideas; and that it will reach the point much better than any other which has yet been suggested or tried. I sincerely hope that this tentative plan, for one year, will receive the approval of this Association. [The recommendation of the Committee was approved.]

The President—I await a motion as to the appointment of such a Committee. It seems to me the best way to secure an effective Committee is to recommit this matter to same committee with a request to report this afternoon the names of an Investigating Committee who shall enter upon this investigation. [Mr. Amory made a motion in conformity with the suggestion of the President's. Motion adopted.]

Election of Officers.

Mr. Sherman—The Committee appointed to nominate officers for the ensuing year recommend that the following-named gentlemen be elected:

President—Thomas Turner, Charleston, S. C.

Vice-Presidents—A. B. Slater, Providence, R. I.; Emerson McMillin, Columbus, O.; J. P. Harbison, Hartford, Conn.

Secretary and Treasurer—C. J. R. Humphreys, Lawrence, Mass.

Finance Committee—C. H. Nettleton, Birmingham, Conn.; A. E. Boardman, Macon, Ga.; W. H. Pearson, Toronto, Ont.

Executive Committee—William Henry White, New York city; G. G. Ramsdell, Vincennes, Ind.; H. B. Leach, Taunton, Mass.; D. H. Geggie, Quebec, Canada.; T. G. Lansden, Washington, D. C.; F. S. Benson, Brooklyn, N. Y.

On motion of Mr. Amory, the Secretary cast the ballot of the Association for the list of officers recommended by the Committee, whereupon the President announced that they were duly elected officers for the ensuing year.

Mr. Harbison and Mr. Clark were appointed a Committee to conduct the President-elect to the platform.

The President—Allow me to present to the Association, Mr. Thomas Turner, the incoming president.

Mr. Turner—Gentlemen of the Association: I suppose that our worthy President expected a few remarks from me; but I have no remarks to make this morning, except to thank you, most heartily, for the honor you have done me, in electing me to the Presidency of this Association. (Applause.)

[*To be continued.*]

End of the Baltimore Gas War.

The Baltimore *Sun* of October 27, in explanation of the peace treaty now under consideration by the gas companies of that city, says:

The gas companies of Baltimore have settled their differences, and on November 1 the price of gas to consumers will be advanced to $1.50 per 1,000 feet, net. The executive committees of the Consolidated and Chesapeake companies were in joint session until late yesterday afternoon, and when they adjourned it was announced that the basis for a settlement had been agreed upon, and that the three existing companies, the Consolidated, Chesapeake and Equitable, will on January 1, 1888, be merged into one concern. The board of directors will meet to-day to ratify the agreement.

Capt. John W. Hall, president of the Consolidated, said: "The differences between the gas companies have been settled, and the price of gas will, on November 1, be advanced to $1.50 net, or $1.60 gross, the price at which it was sold up to the time the Chesapeake went into business, eighteen months ago. The people of Baltimore have had the benefit of cheap gas at a loss to the companies of $2,000,000, and we do not think the advance to $1.50 is more than a fair price, especially for the fine quality of gas which is being furnished to Baltimore consumers. It is worth that price, which will give only a reasonable profit to the producers. The boards may modify the terms of consolidation, but the agreement is practically settled. The stockholders will be called together in thirty days to ratify the agreement, and by January 1 the books will be in shape for the operations of the amalgamated company. The consolidation will be made for economical reasons, and will permit of a desirable reduction in operating expenses."

The reported basis of the merger of the three companies is for the $6,000,000 Consolidated stock to go into the new stock at par, the Chesapeake stock and certificates at one and a-half for one share of the new stock, and the Equitable at four shares for one share of new stock. A well-informed banker said he figured it out that the new amalgamated gas company will have from $10,000,000 to $11,000,000 of capital stock and $5,000,000 or $6,000,000 of bonded debt.

Complaints.

The *Gas World* having previously reviewed some of those complaints that emanate from sources over which the suppliers of gas have at least partial control, in a later issue refers (and pretty cleverly, too) to some which arise from circumstances clearly within the control of the gas user. Our authority goes on to say:

According to the decision given by Mr. Justice Kekewich in the recent lawsuit between the Gas Light and Coke Company and the South Metropolitan Gas Company, it is the common law of the land that gas-supply authorities' responsibilities and control terminate at the meter. From there, as laid down by his Lordship, the consumer can take the gas to any of his property, whether near or far, and use it as he pleases. Whether this decision, which is to be appealed against, will be sustained by the higher courts remains to be seen; but until it is upset, or altered by act of Parliament, it must be considered the law. We know that at Dumbarton, and perhaps in a few other towns, the gas-supply authorities make regulations as to the size of the supply pipes on the consumer's premises, and refuse to supply gas in any instances where those regulations are not complied with. These, however, are rare and singular exceptions to the rule that, after the gas has left the meter, it is absolutely under the control of the consumer. Many gas managers, notably amongst whom may be mentioned Mr. John M'Crae, of Dundee, are desirous that the gasmaker's authority should be extended beyond the meter. Indeed, the gentleman just named expressed the opinion, at the North British Association at Dundee, that the maker's control ought not to cease until the gas appeared in the form of light. There is much to be said for and against these views. But at the present time we do not intend to enter upon this debatable ground beyond expressing the opinion that we think gas-supply authorities ought to have the power to fix the minimum sizes of supply pipes that shall be laid in new buildings, and also to enforce the use of larger supply pipes in existing buildings when complaints about insufficiency of gas are found to be owing to the consumer's pipes being too small. Such an extension of authority appears to us to be reasonable in itself; and that in tens of thousands of instances it would tend greatly to the comfort, convenience, and health of consumers will not be questioned by anyone practically acquainted with the subject.

As a rule, except in the case of cottages, the gas supply in dwelling houses is inadequate for the requirements of the household during winter evenings. The want of supply has originated in ignorance, prejudice, or greed. Few gasfitters, notwithstanding their practical experience, know what sizes of pipes will convey an adequate supply of gas at a suitable pressure for a given number of burners distributed over a building. Their golden rule seems to be to diminish as they get further and further away from the meter. Now, a gas-supply authority would be able either to find or to educate a fitter who would be competent to go into such matters with some approximation to satisfactoriness. Then the prejudice existing in past years is often accountable for insufficient gas supply. Formerly large numbers of people would only allow gas to enter their kitchens and out-buildings, and small pipes were consequently laid down. Gradually they extended the use of gas to the living and sleeping rooms, but got the supply from the old small pipes, which prove insufficient to convey the increased demand. Such is the history of thousands of houses having an insufficient supply of gas. The extensions of premises, without provision for obtaining more gas, bring about similar results. But the jerry-builder has more to answer for in causing short gas supply than anyone else. In his avarice he deliberately cuts down anything whereby he can gain sixpence, and the gas pipes are amongst the first objects to catch his greedy eye. They are reduced, often to the smallest sizes made, regardless of every consideration except gain. The miserable work is afterward covered by the plasterer, and the luckless purchaser or tenant is cursed with wretched gas lights so long as he occupies the house.

Now, from whatever cause it arises, want of gas supply gives rise to numerous complaints, such as dimness of light, unsteadiness of flames, and smoke. When these are made, we think that, having first ascertained that there is a sufficient supply at the meter inlet, some official should examine the consumer's pipes and fittings, and if they are too small, or badly fitted and arranged, advise some definite alterations. It is of little use telling a consumer in an airy manner that he ought to have larger pipes, and have them laid in a proper manner. Such advice is too vague to be followed, and often by its very generality induces the suspicion in the consumer's mind that his adviser knows very little about his business. All this work, we know, will entail labor, and often expense. But neither should be begrudged when there is a call for them. Besides, in most instances, it will well repay the gas supplier both in comfort and in pocket. People whose premises are thoroughly well lighted, whether those premises be the home, the shop, or the mill, rarely grumble about the gas or their bills. The great grumblers are those who get poor results for their money, whatever may be the cause of the defect. Then, of course, when larger services are introduced and more gas is consumed, the suppliers have increased revenues and enhanced profits. These considerations alone ought to be sufficient to prompt gas authorities to take pains to secure that consumers' supply pipes are equal to their requirements.

Now we come to the old sources of dissatisfaction, bad burners. Attention has been so often directed to these that even to allude to them seems like reciting a threadbare tale. But the evils still exist, and therefore they must be hammered at. Burners may be bad to begin with, or they may become bad by use. In either case they want removing. There is no reason why anyone should continue to use a bad burner. Excellent burners are everywhere obtainable, for a copper or two each, and where bad burners are still employed the gas officials ought to advise consumers to buy good ones. Some gas authorities have given good burners to their consumers free of charge, and have also fitted them on to insure their use. The cost is comparatively trifling, but the improvement is immense. In Paisley Mr. Hislop induced the Corporation to make a trial of that plan, and he supplied consumers with burners suited to the prevailing pressures in the various districts of the town. The experiment was a great success, but, unfortunately as we think, the authorities have decided not to continue it. But however good burners are when new, they will not remain so forever. Burners, besides being occasionally cleaned, ought to be changed once a year, and now is the time of the year when the change may be effected with most advantage. As just indicated, the cost is small, and would be repaid in a few hours by the additional light and comfort that would be obtained.

In spite of all that has been written and said, chandelier makers will flood the market with chandeliers fitted to take globes with narrow bottoms, and gasfitters will continue to inflict upon customers such chandeliers and globes to suit them. We say it advisedly that the multiplication of such abominations is a disgrace to the trades concerned therewith. Nothing tends more to make the flames unsteady as globes with narrow openings at the bottom, besides which such a formation obstructs the downward passage of the light. These evils are so great that i ought to be a standing instruction to gas officials to war against the appliances that produce them. Attention ought also to be given to the material of which the globes are made. Opal globes, from a light yielding point of view, are miserable. Globes made of ground glass, figured or plain, are the best for general purposes, and their use should be recommended.

Again, when governor burners are employed, they, too, ought to be of a form and size that will interfere as little as possible with the free, downward passage of the light. Governors in the form of a big bulb, however much they may be decorated, do more harm by obstructing the light than they do good by regulating the flow of gas. The attention of consumers may be profitably directed to these facts. How often we see a costly, cumbrous chandelier, with opal globes having narrow holes at the bottom, or, if the holes be wide, blocked with a big governor, all of which arrangements smother the light and fill the room with gloom. Against such arrangements war should be ceaselessly waged.

Gasfittings ought to be simple and easily understood, and require as little attention as possible. Daily experience shows that the majority of people will not bestow the attention necessary to keep the simplest appliances in good order. Hence gas officials will do well not to hastily recommend complicated or delicate apparatus, however splendid its laboratory results, or however efficient it may be in the hands of an expert.

The Market for Gas Securities.

The city gas share market responded quickly to the improvement in the tone of general speculation, Consolidated moving up to 74 on small transactions. Equitable and Mutual shares also shared in the rise, the advance in the former security being quite marked. Brooklyn shares are seemingly looked at unfavorably by investors, and we think all of these stocks are quoted considerably below their real value. The old Brooklyn Company has declared a semi-annual dividend of 3½ per cent., payable on the 10th inst. While this is a reduction from the rate formerly declared, it must be borne in mind that it is the first return made since the $1.60 legislative gas rate began to affect the Company's earnings. The Baltimore war of rates may be considered a thing of the past, and its settlement has added greatly to the value of gas shares in that city. Those who followed our advice in this instance have no reason to complain of the result. Old Boston shares are lower.

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WEDNESDAY, NOVEMBER 2, 1887.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

NOVEMBER 2.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	73½	74
Central	440,000	50	30	—
" Scrip	220,000	—	47	57
Equitable	2,000,000	100	115	—
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	113
Mutual	3,500,000	100	90	92
" Bonds	1,500,000	1000	101	—
Municipal, Bonds	750,000		—	—
Northern	125,000	50	30	—
" Scrip	108,000			
Yonkers		50	—	80
Richmond Co., S. I.	300,000	50	50	—
" Bonds	12,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	100	105
Citizens	1,200,000	20	50	—
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	128	—
" Bonds	300,000		—	106
Peoples	1,000,000	10	57	60
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	77	80
Nassau	1,000,000	25	90	95
" Ctfs	700,000	1000	95	100
Williamsburgh	1,000,000	50	100	—
" Bonds	1,000,000	—	111	—
Out of Town Gas Companies.				
Boston (Mass.) Gas Co.	2,500,000	500	220	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	140	145
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	40	41
Cincinnati G. & C. Co.	6,000,000	100	182½	185
Consolidated, Balt.	6,000,000	100	70	73
" Bonds	3,600,000		107	107½
Chesapeake, Balt.	1,000,000	100	90	95
"	1,000,000		100	102
Consumers Toronto	1,000,000	50	192	—
Central, S. F., Cal.			—	84
Capital, Sacramento, Cal.			57½	60
Hartford, Conn.	750,000	25	140	142
Jersey City	750,000	20	168	—
Laclede, St. Louis, Mo.	2,000,000	100	125	—
Louisville, Ky.	2,570,000	50	130	132
Little Falls, N. Y.	50,000	100	95	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	220	221
Memphis (Tenn.) Gas	750,000	100	—	—
" Bonds	240,000	100	103	—
New Haven, Conn.		25	193	197
Oakland, Cal.			—	36½
Peoples, Jersey City		—	60	—
" " Bonds			—	—
Paterson, N. J.		25	90	—
Rochester, N. Y.		50	75	80
Syracuse, N. Y.	350,000	25	—	—
St. Louis, Missouri	600,000	50	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	58	59
Washington, D. C.	2,000,000	20	210	—
Wilmington, Del.		50	200	208
Havana (Cuba) Gas Co.	3,000,000	100	18	20
" Bonds	550,000		102	—

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